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FINAL TIEIR II SAMPLING AND ANALYSIS PLAN SITE 47 PRE-DESIGN INVESTIGATION,  
BASELINE, AND POST-INJECTION SAMPLING WITH TRANSMITTAL NSWC INDIAN HEAD  
MD  
7/1/2012  
CH2M HILL



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July 5, 2012

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Subject: Navy CLEAN 8012 Program  
Contract No. N62470-11-D-8012  
Contract Task Order JU05  
Final Tier II Uniform Federal Policy-Sampling and Analysis Plan for Site 47 Pre-Design  
Investigation, Baseline, and Post-Injection Sampling  
Naval Support Facility Indian Head, Indian Head, Maryland

Dear Joe:

CH2M HILL is pleased to submit 2 hard copies and one PDF CD of the subject document for your files. Copies of the document have also been distributed as shown below.

If you have any questions regarding this deliverable, please call me at (703) 376-5154.

Sincerely,

CH2M HILL

*Margaret Kasim*

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CH2M HILL (2 hard copies)

## Title and Approval Page

**Final**  
**Tier II Sampling and Analysis Plan**

**Site 47 Pre-Design Investigation, Baseline, and Post-Injection Sampling**

**Naval Support Facility Indian Head**  
**Indian Head, Maryland**

**Contract Task Order JU05**  
**July 2012**

Prepared for:  
**Department of the Navy**  
**Naval Facilities Engineering Command**  
**Washington**

Under the  
**NAVFAC CLEAN 8012 Program**  
**Contract N62470-11-D-8012**

Prepared by:



**Chantilly, Virginia**

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## Executive Summary

This document presents the Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) for the Pre-Design Investigation, Baseline Sampling, and Post-Injection Sampling of Installation Restoration Program Site 47, Mercuric Nitrate Disposal Area, at the Naval Support Facility Indian Head (NSF-IH) in Indian Head, Maryland. The location of NSF-IH and Site 47 are presented in Figure 1. CH2M HILL prepared this document under the Department of the Navy, Naval Facilities Engineering Command (NAVFAC), Washington, Comprehensive Long-Term Environmental Action Navy 8012 Program, Contract N62470-11-D-8012, Contract Task Order JU05, for submittal to NAVFAC Washington, the U.S. Environmental Protection Agency, and the Maryland Department of the Environment. This document has been developed using the framework of the Navy's Tier II UFP-SAP.

At Site 47, mercuric nitrate was reportedly used from 1957 to 1965 in Building 856 as a catalyst in the production of missile propellant and was disposed of at a location near the southeast corner of the building. Carbon tetrachloride (CT) was also used at the site, presumably as an inerting agent to keep the explosives dry, and may have been poured into drains or stored in drums that may have leaked. Several investigations, including a remedial investigation, have been completed at the site. In addition, a bench-scale study and a pilot study were performed to assess the viability of the selected remedy in the Record of Decision for the shallow groundwater - *in situ* chemical oxidation (ISCO) in the source zone area, monitored natural attenuation (MNA) in the remaining area where the site remediation goals are exceeded, and institutional controls. A component of the selected remedy is short-term performance monitoring, which will occur at 2 months, 6 months, and 9 months following ISCO application. No further action is the selected remedial action for surface soil, subsurface soil, surface water, and sediment.

The objectives of the Pre-Design Investigation are to: 1) refine the understanding of the post-pilot-study boundary of the source area plume for CT and tetrachloroethene (PCE) (500 µg/L isoconcentration line) to determine the actual size of the plume requiring treatment (as part of the full-scale remedy) and 2) refine the understanding of the lithology and characterize the vertical distribution of VOCs in the saturated soil within the source area to ensure the treatment configuration is optimized for substrate delivery. The Pre-Design Investigation field activities consist of collecting membrane interface probe profiles at 12 locations in the North Area and at 16 locations in the South Area of Site 47. In the North Area, direct-push technology (DPT) will be used to advance 4 boreholes to collect four *in situ* groundwater samples and 12 saturated soil samples (3 from each borehole). In the South Area, DPT will be used to advance 5 boreholes to collect 5 *in situ* groundwater samples and 15 saturated soil samples (3 from each borehole). Eight permanent monitoring wells will then be installed—four in the North Area and four in the South Area.

The objectives of the baseline and short-term performance monitoring for groundwater are to: 1) assess ISCO performance in terms of VOC mass/concentration reductions in groundwater, 2) assess ISCO performance in terms of VOC mass reductions in saturated soil, 3) demonstrate whether metals are being mobilized downgradient as a result of ISCO, 4) determine whether the oxidation processes have ceased at 9 months post-ISCO injections, and the extent to which pre-injection conditions return in groundwater, and 5) assess the impacts, if any, ISCO has on NA (reductive dechlorination) parameters/conditions in groundwater. Twenty-two monitoring wells will be sampled to establish baseline conditions before implementing the remedial action. The wells will then be sampled at 2-month, 6-month, and 9-month intervals following ISCO application. The monitoring wells will be sampled for site-specific constituents of concern (COCs) as well as for performance indicator parameters that will allow the effectiveness of the injections to be monitored and the effectiveness of MNA processes to be evaluated. Eight saturated soil samples will also be collected during baseline sampling and the 9-month post injection sampling for the site-specific groundwater COCs and total organic carbon. The sampling approach is shown below. Following the 9-month post-injection sampling, the long-term monitoring approach for Site 47 will be developed.

Analyte	Number of wells to be sampled				Proposed wells to sample		
	Baseline	2-Month post injection	6-month post injection	9-month post injection	Existing Perimeter Wells	Existing Source Area wells	New Proposed Wells
TCL VOCs	22	22	22	22	1, 2, 5, 6, 9, 10	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
TAL Metals	22	22	22	22	1, 2, 5, 6, 9, 10	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
TAL Metals – Dissolved	22	22	22	22	1, 2, 5, 6, 9, 10	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
TOC	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Sulfate	16	16	16	16	None	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
Sulfide	16	0	0	16	None	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
Nitrate	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Ferrous Iron	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Ferric Iron	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Methane, Ethane, Ethene	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Alkalinity	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
qPCR	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Persulfate	16	16	16	16	None	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32

qPCR = quantitative polymerase chain reaction

TAL = target analyte list

Analyte	Number of Borings		Proposed Soil Boring Locations	
	Baseline	9-month post injection	Perimeter Source Area Locations	Between Wells in Source Area
TCL VOCs	8	8	Near new MWs 25, 26, 27, 30	Near Pilot Study Sampling Locations
TAL Metals	8	8	Near new MWs 25, 26, 28, 31	Near Pilot Study Sampling Locations
TOC	8	8	Near new MWs 25, 26, 28, 33	Near Pilot Study Sampling Locations

CH2M HILL prepared this UFP-SAP in accordance with the Navy's UFP-SAP policy guidance to ensure that environmental data collected are scientifically sound, of known and documented quality, and suitable for intended uses. The laboratory information cited in this UFP-SAP is specific to Environmental Conservation (ENCO) Laboratories in Orlando, Florida. ENCO Laboratories was selected based on a competitive selection process and will provide all analytical laboratory support for this project. If analytical changes are required, a technical memorandum, including revised UFP-SAP worksheets as appropriate, will be prepared to document the revisions to the UFP-SAP. An addendum will be prepared to address the persulfate preservation approach prior to baseline sampling.

This UFP-SAP contains the required elements outlined in the Navy's UFP-SAP Tier II guidance. Tables are embedded within the document and figures are provided following the text. Laboratory-specific information is provided as **Appendix A**, the laboratory's Department of Defense Environmental Laboratory Accreditation Program accreditations, are provided as **Appendix B**, and the Health and Safety Plan is provided as **Appendix C**.

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#### **Appendices**

<b>A</b>	Laboratory-Specific Information
<b>B</b>	Laboratory Department of Defense Environmental Laboratory Accreditation Program Accreditation Letters
<b>C</b>	Health and Safety Plan

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<b>1</b>	Facility Map
<b>2</b>	Site Layout
<b>3</b>	Conceptual Site Model of Site 47
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## Acronyms and Abbreviations

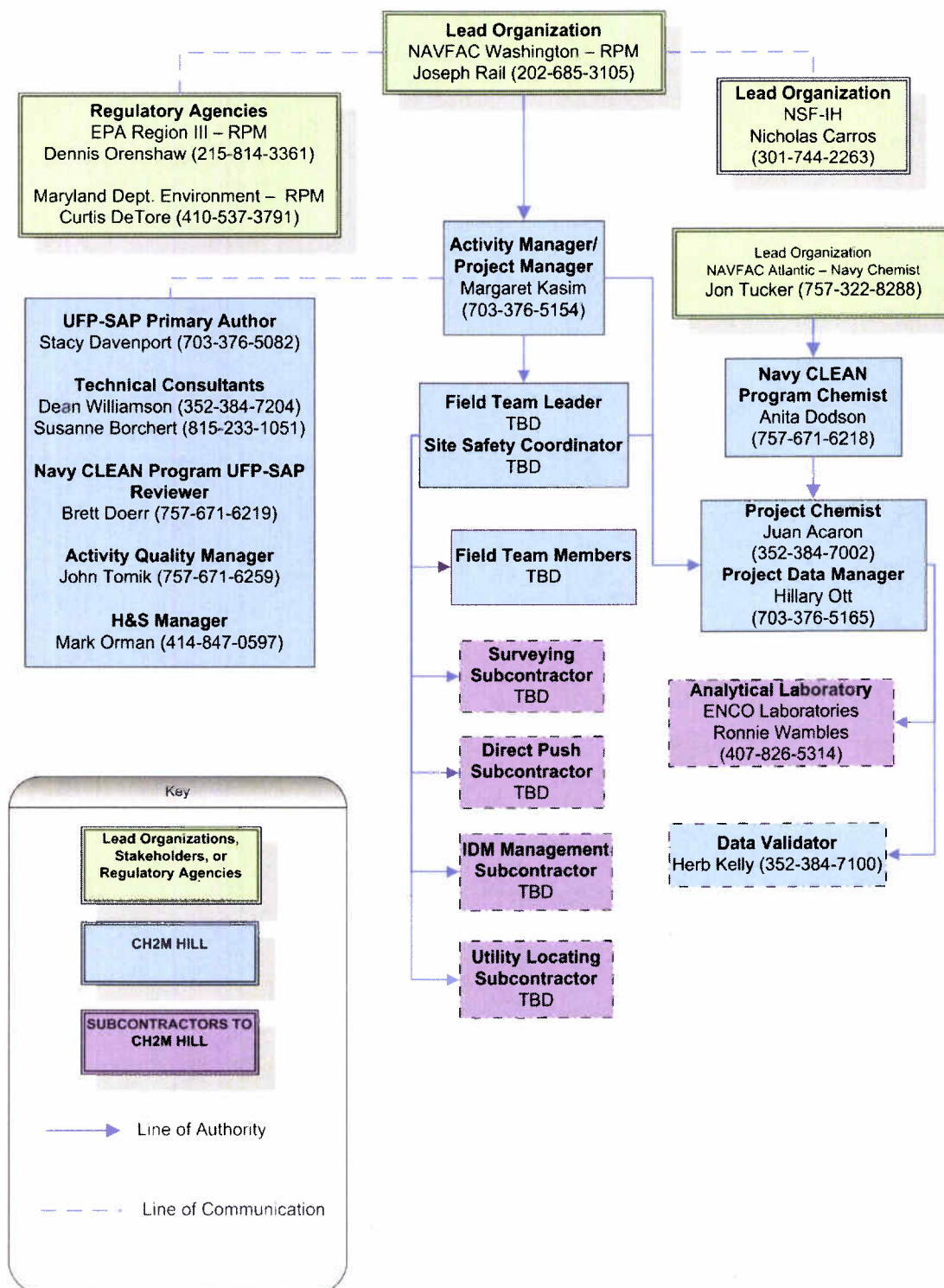
°C	degrees Celsius
%R	percent recovery
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AAP	alkaline-activated sodium persulfate
AM	Activity Manager
AQM	Activity Quality Manager
BERA	baseline ecological risk assessment
CA	corrective action
CLEAN	Comprehensive Long-Term Environmental Action Navy
CoC	chain-of-custody
COC	constituent of concern
COPC	constituent of potential concern
CSM	conceptual site model
CT	carbon tetrachloride
DNAPL	dense non-aqueous phase liquid
DoD QSM	Department of Defense Quality Systems Manual
DOT	U.S. Department of Transportation
DPT	direct-push technology
DQI	data quality indicator
DQO	data quality objective
ENCO	Environmental Conservation
EPA	U.S. Environmental Protection Agency
FS	feasibility study
ft/day	foot/feet per day
FTL	Field Team Leader
GPS	global positioning system
HASP	Health and Safety Plan
HDPE	high-density polyethylene
HHRA	human health risk assessment
IC	institutional control
ICAL	initial calibration
ICS	Interference Check Solutions
IDW	investigation-derived waste
IHIRT	Indian Head Installation Restoration Team
ISCO	<i>in situ</i> chemical oxidation
ISCR	<i>in situ</i> chemical reduction
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
LUC	land use control
MCL	maximum contaminant level

MDE	Maryland Department of the Environment
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MIP	membrane interface probe
mL	milliliter(s)
MNA	monitored natural attenuation
MS/MSD	matrix spike/matrix spike duplicate
NA	natural attenuation
NAVFAC	Naval Facilities Engineering Command
NSF-IH	Naval Support Facility Indian Head
PA	preliminary assessment
PAL	Project Action Limit
PCE	tetrachloroethene
PDM	Project Data Manager
PDS	post-digestion spike
PID	photoionization detector
PM	Project Manager
POC	point of contact
PPE	personal protective equipment
PQL	project quantitation limit
QA/QC	quality assurance/quality control
QAO	Quality Assurance Officer
QL	quantitation limit
qPCR	quantitative polymerase chain reaction
RI	remedial investigation
RL	reporting limit
ROD	Record of Decision
RPD	relative percent difference
RPM	Remedial Project Manager
SERA	screening ecological risk assessment
SOP	standard operating procedure
SRG	site remediation goal
SVOC	semivolatile organic compound
TAL	target analyte list
TBD	to be determined
TCE	trichloroethene
TCL	target compound list
TOC	total organic carbon
UFP-SAP	Uniform Federal Policy Sampling and Analysis Plan
VC	vinyl chloride
VOC	volatile organic compound
ZVI	zero valent iron

## SECTION 1

# 1 Project Organization

## 1.1 Project Organizational Chart



## 1.2 Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Communication with Navy (lead agency)	U.S. Naval Facilities Engineering Command (NAVFAC) Washington Remedial Project Manager (RPM)	Joseph Rail	202-685-3105 <a href="mailto:joseph.rail@navy.mil">joseph.rail@navy.mil</a>	Primary point of contact (POC) for Navy. Delegates communication to other internal or external POCs. Notifies U.S. Environmental Protection Agency (EPA) and Maryland Department of the Environment (MDE) via email within 24 hours of field changes affecting the scope or implementation of the design. Participates in the onboard review discussion.
Communication with Navy	NAVFAC Atlantic Navy Chemist	Jon Tucker	757-322-8288 <a href="mailto:Jonathan.tucker@navy.mil">Jonathan.tucker@navy.mil</a>	Reviews Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) and provides input for NAVFAC Washington. Navy Chemist will have 21 working days for UFP-SAP review.
Communication with MDE	MDE Tier I RPM	Curtis DeTore	410-537-3791 <a href="mailto:cdetore@mde.state.md.us">cdetore@mde.state.md.us</a>	Primary /secondary POC for MDE. Delegates communication to other internal or external POCs. Has 30 days for UFP-SAP review. Participates in the onboard review discussion.
Communication with EPA	EPA Region III RPM	Dennis Orenshaw	215-814-3361 <a href="mailto:Orenshaw.Dennis@epamail.epa.gov">Orenshaw.Dennis@epamail.epa.gov</a>	Primary POC for EPA. Delegates communication to other internal or external POCs. Has 30 days for UFP-SAP review. Participates in the onboard review discussion.
Communication with Naval Support Facility Indian Head (NSF-IH)	Base Environmental Contact	Nicholas Carros	301-744-2263 <a href="mailto:nicholas.carros@navy.mil">nicholas.carros@navy.mil</a>	Primary POC for NSF-IH. Delegates communication to other internal or external POCs. Will be provided with daily reports of all construction activities. If field issues occur that affect the mission of the facility, the Installation Restoration Program Project Manager (PM) or his delegate should be notified immediately.
Communication regarding overall project status and implementation and primary POC with Navy RPM, EPA, and MDE	CH2M HILL Activity Manager (AM)	Margaret Kasim	703-376-5154 <a href="mailto:margaret.kasim@ch2m.com">margaret.kasim@ch2m.com</a>	Forwards all relevant information and materials about the project to Joseph Rail (NAVFAC Washington), Dennis Orenshaw (EPA), and Curtis DeTore (MDE) on an as-needed basis. Oversees the overall project status.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Technical communications for project implementation and data interpretation	CH2M HILL Activity Quality Manager (AQM)	John Tomik	757-671-6259 <a href="mailto:john.tomik@ch2m.com">john.tomik@ch2m.com</a>	To be contacted regarding questions/issues encountered in the field, input on data interpretation, as needed.  Reviews the data as necessary before Indian Head Installation Restoration Team (IHIRT) discussion
Communications regarding project management and implementation of all project phases, and primary POC with Navy RPM	CH2M HILL PM	Margaret Kasim	703-376-5154 <a href="mailto:margaret.kasim@ch2m.com">margaret.kasim@ch2m.com</a>	Forwards all relevant information and materials about the project to Joseph Rail (NAVFAC Washington), Dennis Orenshaw (EPA), and Curtis DeTore (MDE) on an as-needed basis.  Oversees the overall project status.
UFP-SAP implementation in the field	CH2M HILL Field Team Leader (FTL)	To be determined (TBD)	TBD	Facilitates CH2M HILL's internal communication (PM to field team members).  Coordinates schedules and field activities with driller, utility locator, and investigation-derived waste (IDW) subcontractors.  Communicates with subcontractors by phone, followed up with e-mail to document decisions and actions.  Documents deviations from the Work Plan in the field log book and notifies PM immediately.  Executes deviations only after PM approval.  Implements project health and safety requirements.  Reports health and safety near-misses and incidents to the PM immediately by phone.  Provides daily progress reports/updates to the CH2M HILL PM by phone or email.  Communicates with the field team and PM on a daily basis.
Communication regarding overall quality of the UFP-SAP	CH2M HILL Navy Comprehensive Long-Term Environmental Action Navy (CLEAN) Program UFP-SAP Reviewer	Brett Doerr	757-671-6219 <a href="mailto:brett.doerr@ch2m.com">brett.doerr@ch2m.com</a>	Provides program-level technical and quality review of UFP-SAP within a week of receiving the SAP from the project team.
Communication regarding overall quality of the UFP-SAP from a chemistry perspective	CH2M HILL Navy CLEAN Program Chemist	Anita Dodson	757-671-6218 <a href="mailto:Anita.dodson@ch2m.com">Anita.dodson@ch2m.com</a>	Provides program-level chemistry review of the UFP-SAP within a week of receiving the SAP from the project team.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Health and safety expectations and procedures	CH2M HILL Health and Safety Officer	Mark Orman	414-847-0597 <a href="mailto:mark.orman@ch2m.com">mark.orman@ch2m.com</a>	Responsible for the adherence of team members to the site safety requirements described in the Health and Safety Plan (HASP). Reports health and safety incidents and near-losses to PM on an as-needed basis.
Field corrective actions (CAs)	CH2M HILL FTL and PM	TBD Margaret Kasim	TBD <a href="mailto:margaret.kasim@ch2m.com">margaret.kasim@ch2m.com</a>	Summary of field CAs taken will be provided to the Navy within 2 days of incident that requires field CA.
Overseeing staff health and safety in the field	CH2M HILL Site Safety Coordinator	TBD	TBD	Responsible for daily safety tailgates, weekly observations, and real-time discussions of observations and changes to be implemented with field staff.
Data tracking from collection through upload to database	CH2M HILL Project Data Manager (PDM)	Hillary Ott	703-376-5165 <a href="mailto:hillary.ott@ch2m.com">hillary.ott@ch2m.com</a>	Tracks data from sample collection through upload to the database, ensuring Work Plan requirements are met by the laboratory and field staffs. POC for laboratory Quality Assurance Officer (QAO). Reports the lab issues to the PM and Project Chemist within 4 hours.
Management of analytical lab and data validation subs. Analytical CAs/ release of analytical data	CH2M HILL Project Chemist	Juan Acaron	352-384-7002 <a href="mailto:juan.acaron@ch2m.com">juan.acaron@ch2m.com</a>	Analytical laboratory CAs will be identified by, or brought to the attention of, the Project Chemist on a daily basis and reported to the PM within 4 hours. Facilitates resolution on a same-day basis after consulting with the PM, AQM, and the Navy Chemist (if changes in the UFP-SAP are warranted) to ensure UFP-SAP requirements are met by the laboratory. Approves release of analytical data after validation is completed and approved by the Project Chemist within 7 days. Communicates with subcontractor laboratory(ies) and data validator by phone, followed up with e-mail to document decisions and actions. Informs PM, RPM, and Navy Chemist of any laboratory issues that would cause negative impacts to project delivery or would cause the project data quality objectives (DQOs) to not be met.
Reporting laboratory data quality issues	Laboratory QAO or PM	Ronnie Wambles	407-826-5314 <a href="mailto:rwambles@encolabs.com">rwambles@encolabs.com</a>	Reports all quality assurance/quality control (QA/QC) issues with project field samples to the Project Chemist as soon as identified, not to exceed 24 hours.
Validation of analytical lab data	CH2M HILL Data Validator	Herb Kelly	352-384-7100 <a href="mailto:herb.kelly@ch2m.com">herb.kelly@ch2m.com</a>	Data validation of analytical laboratory data.

## SECTION 2

# 2 Project Approach

## 2.1 Project Scoping Session 1

<b>Project Name:</b> Pre-Design Investigation, Baseline, and Post-Injection Sampling <b>Projected Date(s) of Sampling:</b> Spring 2012 <b>Project Manager:</b> Margaret Kasim/CH2M HILL		<b>Site Name:</b> Site 47 <b>Site Location:</b> NSF-IH/Indian Head, MD		
<b>Date of Session:</b> February 16, 2012 <b>Scoping Session Purpose:</b> Site 47 Additional Investigation Scoping Session				
Name	Title/Project Role	Affiliation	Phone #	E-mail Address
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Gunarti Coghlan	NAVFAC Washington Technical Lead	Navy	202- 433-0154	<a href="mailto:gunarti.coghlan@navy.mil">gunarti.coghlan@navy.mil</a>
Nate DeLong	NAVFAC Washington RPM	Navy	202-685-3297	<a href="mailto:nathan.delong@navy.mil">nathan.delong@navy.mil</a>
Nicholas Carros	NSF-IH RPM	NSF-IH	301-744-2263	<a href="mailto:nicholas.carros@navy.mil">nicholas.carros@navy.mil</a>
Dennis Orenshaw	EPA RPM	EPA	215-814-3361	<a href="mailto:orenschow.dennis@epamail.epa.gov">orenschow.dennis@epamail.epa.gov</a>
Curtis DeTore	MDE RPM	MDE	410-537-3791	<a href="mailto:cdetore@mde.state.md.us">cdetore@mde.state.md.us</a>
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Dean Williamson	Senior Technical Consultant	CH2M HILL	352-384-7204	<a href="mailto:dean.williamson@ch2m.com">dean.williamson@ch2m.com</a>
Susanne Borchert	<i>In-situ</i> Chemical Oxidation (ISCO) Subject Matter Expert	CH2M HILL	815-233-1051	<a href="mailto:susanne.borchert@ch2m.com">susanne.borchert@ch2m.com</a>
Mark Strong	Design Engineer	CH2M HILL	704-543-3289	<a href="mailto:mark.strong@ch2m.com">mark.strong@ch2m.com</a>
Vicki Waranoski	Lead Engineer	CH2M HILL	703-376-5049	<a href="mailto:victoria.waranoski@ch2m.com">victoria.waranoski@ch2m.com</a>
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<b>Comments:</b> The goal of this meeting was to discuss and concur upon the sampling and analysis approach for Site 47 Pre-Design Investigation, baseline, and short-term (2-month, 6-month, and 9-month) post-injection events to be presented in a UFP-SAP.  The source area plume for Site 47 defined from the remedial investigation (RI) and pre-feasibility study (FS) investigation covers approximately 50,000 square feet, and limited data are available regarding subsurface lithology and vertical distribution of groundwater constituents of concern (COCs) in saturated soil. The objectives of the Pre-Design Investigation are to better define the boundary of the source area plume, determine the size of the plume requiring treatment, refine the understanding of the lithology, and delineate the vertical distribution of volatile organic compounds (VOCs) in the saturated soil.  Curtis and Dennis mentioned that the plume should be well-defined based on the multiple membrane interface probe (MIP) investigations conducted during the RI. Gunarti Coghlan pointed out that the Pre-Design Investigation data will be used to configure the treatment system. In addition, the new MIP data will be used to help with the placement of the monitoring wells. Dennis and Curtis concurred with the explanation.  The Pre-Design Investigation in the North Area of Site 47 will include: <ul style="list-style-type: none"><li>• Conducting MIP profiles at 12 locations</li><li>• Advancing boreholes using direct-push technology (DPT) at four locations, collecting up to 4 <i>in situ</i> groundwater samples (1 sample per borehole) and 12 saturated soil samples (3 samples per borehole). All samples will be analyzed for target compound list (TCL) VOCs. Saturated soil samples will also be analyzed for total organic carbon (TOC).</li></ul>				

**Project Name:** Pre-Design Investigation, Baseline, and Post-Injection Sampling  
**Projected Date(s) of Sampling:** Spring 2012  
**Project Manager:** Margaret Kasim/CH2M HILL

**Site Name:** Site 47  
**Site Location:** NSF-IH/Indian Head, MD

- Installing four permanent monitoring wells

The Pre-Design Investigation in the South Area of Site 47 will include:

- Conducting MIP profiles at 16 locations
- Advancing boreholes using DPT at five locations, collecting up to 5 *in situ* groundwater samples (1 sample per borehole) and 15 saturated soil samples (3 samples per borehole). All samples will be analyzed for TCL VOCs. Saturated soil samples will also be analyzed for TOC.

- Installing four permanent monitoring wells

The intervals from which the saturated soil samples will be collected will be selected based on the MIP results and the use of field screening tools (photoionization detector [PID] and color-TEC) during DPT activities. Dennis asked what we would get from the eight new permanent wells to be installed. Gunarti said that they will be used in the short-term and long-term groundwater monitoring network. Dennis asked if dense non-aqueous phase liquid (DNAPL) VOCs would be observed in the soil. Dean replied that we believe it is unlikely that we will visually observe any DNAPL in soil samples but that we can determine whether any DNAPL is present in the soil samples based on the concentrations of VOCs detected.

The short-term performance groundwater sampling will include baseline sampling as well as 2-, 6-, and 9-month post-ISCO application sampling events for groundwater and soil. The objectives of the groundwater sampling are: to assess the ISCO performance in terms of VOC mass/concentration reductions, to demonstrate that metals are not being mobilized downgradient as a result of ISCO, to determine whether the oxidation processes have ceased at 9 months post-ISCO injections, and to assess the impacts, if any, ISCO had on natural attenuation (NA) and reductive dechlorination parameters and conditions. The objectives of the soil sampling are to assess ISCO performance in terms of VOC mass reductions and to demonstrate that metals are not being mobilized downgradient as a result of ISCO.

Groundwater samples will be collected from up to 22 monitoring wells (from 14 existing wells and 8 new wells). The proposed sampling approach discussed during the call is shown below.

Analyte	Number of wells to be sampled				Proposed wells to sample		
	Baseline	2-Month post injection	6-month post injection	9-month post injection	Existing Perimeter Wells	Existing Source Area wells	New Proposed Wells
TCL VOCs	22	22	22	22	1, 2, 5, 6, 9, 10	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
TAL Metals	22	22	22	22	1, 2, 5, 6, 9, 10	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
TAL Metals – Dissolved	22	22	22	22	1, 2, 5, 6, 9, 10	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
TOC	0	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Sulfate	16	16	16	16	None	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
Sulfide	0	0	0	16	None	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32
Nitrate	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Ferrous Iron	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Ferric Iron	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Analyte	Baseline	2-Month post injection	6-month post injection	9-month post injection	Existing Perimeter Wells	Existing Source Area wells	New Proposed Wells

<b>Project Name:</b> Pre-Design Investigation, Baseline, and Post-Injection Sampling <b>Projected Date(s) of Sampling:</b> Spring 2012 <b>Project Manager:</b> Margaret Kasim/CH2M HILL				<b>Site Name:</b> Site 47 <b>Site Location:</b> NSF-IH/Indian Head, MD			
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Methane, Ethane, Ethene	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Alkalinity	11	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
qPCR	0	0	0	11	1, 5	3, 19, 22, 23, 24	26, 28, 30, 32
Persulfate	16	16	16	16	None	3, 4, 19, 20, 21, 22, 23, 24	25, 26, 27, 28, 29, 30, 31, 32

TAL = target analyte list

Gunarti suggested that qPCR should be added to the baseline groundwater sampling event to capture the microbial community information before treatment. She also suggested adding TOC to baseline sampling because it will be affected by ISCO. TOC is one of the critical indicators of NA, so it would be advantageous to know to what extent ISCO affects TOC. Margaret and Dean agreed to add this.

The proposed soil sampling approach presented during the call is shown below.

Analyte	Number of Borings		Proposed Soil Boring Locations	
	Baseline	9-month post injection	Perimeter Source Area Locations	Between Wells in Source Area
TCL VOCs	8	8	Near new MWs 25, 26, 27, 30	Near Pilot Study Sampling Locations
TAL Metals	8	8	Near new MWs 25, 26, 28, 31	Near Pilot Study Sampling Locations
TOC	8	0	Near new MWs 25, 26, 28, 33	Near Pilot Study Sampling Locations

Gunarti suggested that TOC should be added to the 9-month post injection groundwater sampling event. Margaret agreed to add this.

Dennis asked if the site remediation goals (SRGs) are all maximum contaminant levels (MCLs). Margaret responded that the SRGs can be preliminary remediation goals, MCLs, and background numbers.

The proposed schedule for this project is:

- Pre-draft UFP-SAP: mid-March 2012; submit to Navy and Navy Chemist for expedited review
- Draft UFP-SAP: early April 2012; submit to IHIRT for expedited review (possibly onboard review)
- Final UFP-SAP – mid-April 2012
- Fieldwork – Start end of April/early May 2012

**Action Items:**

CH2M HILL – Complete pre-draft UFP-SAP.

**Consensus Decisions:**

Obtained Team consensus to move forward with preparation of the pre-draft UFP-SAP.

## 2.2 Background and History

### 2.2.1 Site Location, History, and Description

NSF-IH is located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, DC. NSF-IH is a Navy facility consisting of the Main Installation on the Cornwallis Neck Peninsula and the Stump Neck Annex on the Stump Neck peninsula. The Main Installation contains approximately 2,500 acres and is

bounded by the Potomac River to the northwest, west, and south; Mattawoman Creek to the south and east; and the town of Indian Head to the northeast. Included as part of the Main Installation are Marsh Island and Thoroughfare Island, which are located in Mattawoman Creek.

Site 47 is located in the central portion of the Main Installation (Figure 1). The site is in an upland area that gently slopes to the southeast and encompasses Buildings 856, 856A, 856B, 856C, and 1794, and the drainage swale that discharges to Site 8. Buildings within the site are used as offices, laboratories, and magazines. Surrounding land consists of mowed grass and a narrow drainage ditch, which originates off the southeastern corner of Building 856 and flows south. From 1957 to 1965, mercuric nitrate was used in Building 856 as a catalyst in the production of missile propellant and was reportedly disposed at a location near the southeast corner of the building. The disposal area was approximately 24 square feet (4 feet by 6 feet) and was covered with limestone chips to provide neutralization for the spent catalyst (composed of nitric acid); evidence of the disposal area no longer exists. Carbon tetrachloride (CT) was used at the site, likely to keep explosives dry, and may have been poured into drains or stored in drums that may have leaked. Although its origin is unknown, tetrachloroethene (PCE) was also found at the site during the RI.

During the remedial alternative development during the FS, a modeling exercise was conducted to estimate the remediation timeframe and uncertainties with relying on NA processes as a sole remedy. The projected remedial timeframes indicated that sole reliance on NA processes to treat the DNAPL source zone was not feasible; therefore, active source area treatment was recommended to expedite the overall remediation timeframe. A target concentration for CT and PCE to be reached during active source area treatment, which would result in a reasonable remediation timeframe (less than 30 years) if NA processes were used as a polishing step to achieve the SRGs, was calculated. It was determined that a target concentration of 500 micrograms per liter ( $\mu\text{g/L}$ ) for both CT and PCE would allow NA processes to achieve the SRGs within 52 years. Although 52 years is longer than the ideal 30-year remediation timeframe, the IHIRT agreed that 52 years was a reasonable remediation timeframe for Site 47.

In the FS, the area of attainment for the shallow groundwater, which is the area over which the remedial action objectives and, therefore, the SRGs are to be met, was identified. Soil is not a medium of concern at Site 47; it does not have COCs or an area of attainment. For the shallow groundwater, the area of attainment consists of a source area and dissolved plume area (Figure 2). The source area is defined by the potential presence of separate-phase contaminants or the area where the aqueous phase concentrations of the primary contaminants, CT or PCE, are greater than 500  $\mu\text{g/L}$ . The dissolved plume area is the location outside the source area where concentrations of CT and PCE are less than 500  $\mu\text{g/L}$  but exceed the SRGs. Based on the concentrations of CT and PCE, the source area was further divided into two areas: North Area and South Area. The North Area is where CT and PCE concentrations are higher than 10,000  $\mu\text{g/L}$ ; it is also referred to as the residual DNAPL area. The South Area is where concentrations of CT and PCE are between 500  $\mu\text{g/L}$  and 10,000  $\mu\text{g/L}$ . The selected remedy in the Record of Decision (ROD) for the shallow groundwater is ISCO in the source area, monitored natural attenuation (MNA) in the remaining area where the SRGs are exceeded, and institutional controls (ICs).

## 2.2.2 Site Geology

Soil at Site 47 consists of sand and silty sand from the ground surface to an approximate depth between 7 and 24 feet below ground surface, depending on the surface elevation and location. Underlying the sand and silty sand is a dense, gray clay that appears to be more than 30 feet thick.

## 2.2.3 Site Hydrogeology

The water table elevation ranges from 34.4 feet to 37.0 feet above mean sea level and approximately 6 feet to 8 feet below ground surface. Groundwater flows southeast across the site toward the Site 12 Pond and Mattawoman Creek.

## 2.2.4 Habitats and Biota

Most of Site 47 is dominated by mowed grass. A narrow drainage ditch originates off the southeastern corner of Building 856 and flows south, towards Caffee Road, eventually becoming a stream. At its beginning, the ditch is 1 foot to 2 feet wide with mowed, grassy banks. The substrate of the ditch is soil, with no wetland vegetation present for most of its length. The drainage ditch broadens to approximately 3 feet in width near Magazine 1070. Near Magazine 1073, some of the bank is unmowed, and standing water and wetland vegetation are present. Herbaceous wetland vegetation in the channel near Magazine 1073 includes beggars-ticks (*Bidens frondosa*), soft rush (*Juncus effusus*), and wool grass (*Scirpus cyperinus*). In addition, tadpoles (unidentified species) have been observed in the drainage ditch upgradient of Magazine 1073. The drainage ditch is bordered by open forest to the east. The forest has a mature canopy with little understory or ground cover. The canopy is dominated by chestnut oak (*Quercus prinus*), sweetgum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*). The subcanopy is dominated by American holly (*Ilex opaca*). The sparse shrub layer is dominated by highbush blueberry (*Vaccinium corymbosum*). The drainage ditch becomes a stream bordered by forest on both sides as it continues south past Building 854 and crosses Caffee Road through a 36-inch culvert. The stream is bordered by upland forest dominated by sweetgum. The stretch of the stream immediately downstream of Caffee Road was excavated as part of the Site 8 remediation. East of the Site 8 excavation area, the stream flows through a forested area before entering the Site 12 pond.

## 2.2.5 Previous Investigations

### Preliminary Assessment

The objective of the preliminary assessment (PA) (Naval Energy and Environment Support Activity, 1992) was to document past and present operations and disposal practices at several sites and recommend further action if there was a potential threat to human health or the environment. The PA concluded that, based on the soil characteristics and solubility of the mercuric nitrate and its salt precipitate, mercury may have migrated into the shallow groundwater at the site. The PA recommended a site inspection with soil sampling for Site 47.

### Site Inspection

The objective of the site inspection was to determine if contamination was present in soil at Site 47 (Ensafe/Allen & Hoshall, 1994). Twelve soil samples were collected from locations near the former mercury disposal pit at Site 47. The sampling results did not conclusively identify the location of the former mercuric nitrate disposal pit. As a result, it was recommended that an additional study be conducted to evaluate the nature and extent of contamination from VOCs, semivolatile organic compounds (SVOCs), and metals.

### Remedial Investigation

The RI for Site 47 was performed in several phases between 1999 and 2002 (CH2M HILL, 2003). The objectives were to: 1) characterize the geologic and hydrogeologic characteristics of the area underlying and surrounding the site; 2) characterize the nature, extent, and concentrations of site-related contaminants in concrete troughs, surface soil, sediment, and groundwater, and determine the rate of migration of site-related contaminants in the environment; and 3) identify actual or potential human health or environmental risks.

In general, the RI findings indicated that detected constituents in surface soil, subsurface soil, sediment, surface water, and concrete were at low concentrations. For groundwater, there were high detections of chlorinated VOCs, SVOCs, and metals.

As part of the RI, a human health risk assessment (HHRA) and a screening ecological risk assessment (SERA) were conducted (results of these assessments are presented below). The RI recommended that an FS be performed and additional data be collected to further delineate the nature and extent of contamination in groundwater at Site 47.

## Pre-FS Investigation

In 2004, a pre-FS investigation was conducted to further assess the viability of MNA as a remedial alternative for the shallow groundwater (CH2M HILL, 2008). Field activities included installation of three monitoring wells, collection and analyses of groundwater samples from five existing and three new monitoring wells for VOCs and MNA parameters, collection and analysis of groundwater samples from four monitoring wells for TAL metals/cyanide, performance of slug tests at two existing and one newly installed well to assess the horizontal and vertical hydraulic conductivities of the clay layer, and analysis of a soil sample for soil oxidant demand to assess the viability of potassium permanganate as an ISCO reagent.

In general, the results indicated that MNA is a viable alternative for CT and its breakdown products, PCE, and trichloroethene (TCE). The MNA parameters indicated a reducing condition of the shallow groundwater that would promote the mobilization of metals from the aquifer materials. The slug test demonstrated a horizontal hydraulic conductivity range of 0.6 foot per day (ft/day) to 19.7 ft/day; vertical hydraulic conductivities from the clay layer ranged from  $5.2 \times 10^{-5}$  ft/day to  $4.6 \times 10^{-4}$  ft/day. The soil oxidant demand results indicated that potassium permanganate would not be a viable ISCO technology.

## Bench-scale Study

A bench-scale study was conducted in 2007 to evaluate technologies including ISCO using alkaline-activated sodium persulfate (AAP) and catalyzed hydrogen peroxide, and *in situ* chemical reduction (ISCR) using various particle sizes of zero valent iron (ZVI) (CH2M HILL, 2008). The objectives of the bench-scale study were to: (1) evaluate the effectiveness of select ISCO and ISCR technologies in treating a mixture of CT and PCE in the shallow aquifer, (2) determine the site-specific demand of reagents, and (3) identify potential side effects of the select technologies that may not be compatible with the current site use. The bench-scale study concluded that AAP is the most effective treatment reagent for CT and PCE, reducing their concentrations by more than 98 percent. In addition, because AAP is compatible with the current site setting and land uses, it is implementable. A pilot study was recommended to evaluate the performance of AAP at the site.

## Feasibility Study

An FS was completed to address potential sources of contamination at Site 47 and to evaluate remedial alternatives to mitigate potential hazards associated with the shallow groundwater contamination (CH2M HILL, 2008). The FS report presents the preliminary screening of the remedial technologies and process options for each general response action developed to meet the remedial action objectives for Site 47 shallow groundwater. The retained technologies and process options were: no action, land use controls (LUCs), groundwater monitoring and NA, ISCO, and ISCR. Further screening of the retained technologies or options was also discussed for ISCO and ISCR because these technologies cover a broad range of reagents that may not all be applicable for Site 47 shallow groundwater.

Based on the results of the bench-scale study noted above, ISCR was eliminated because ISCR technologies using various particle forms of ZVI were found to be inefficient for treating both CT and PCE that are inferred to be present as DNAPL. Furthermore, ZVI application via mixing entails significant and prolonged interference with the daily operations of the facility. The technologies and process options that were retained for the remedial alternative assembly based on the bench-scale study were: no action, LUCs, ISCO technology using AAP as an oxidant, and groundwater monitoring for NA.

As a result, the two alternatives evaluated in the FS were (1) no action and (2) source area treatment using ISCO, NA processes, groundwater monitoring, and LUCs (CH2M HILL, 2008). In the FS, COCs for the shallow groundwater were identified based on an assessment of a dataset that included data from the RI and pre-FS.

## Pilot Study

A pilot study was conducted in 2009 and 2010 to develop the design parameters for full-scale implementation of AAP and to assess potential incompatibility with current site uses (explosives research and storage area) and MNA (CH2M HILL, 2011a). The pilot study covered an area of approximately 3,500 square feet within the inferred

DNAPL area. A total of 85,408 gallons of AAP, at concentrations ranging between 55 and 80 grams per liter, were injected into 14 pairs of shallow and deep injection wells. The AAP performance was evaluated after a baseline monitoring event and 2-month and 6-month post-injection events. The overall results indicated that AAP reduced CT and PCE concentrations over time. CT and PCE concentrations in the saturated soil were reduced by approximately 90 percent and 61 percent, respectively; the reduction in CT and PCE concentrations in groundwater was observed at 80 percent and 45 percent, respectively.

### **Proposed Plan**

A Proposed Plan was completed to present the remedial alternatives evaluated and recommended for addressing contaminated shallow groundwater at Site 47 (CH2M HILL, 2011b). The preferred alternative was identified as ISCO in the source area where the CT and PCE concentration exceeds 500 µg/L, MNA in the remaining area where the SRGs are exceeded, and ICs. No further remedial action was presented for surface soil, subsurface soil, surface water, and sediment because no COCs were identified in these media from the HHRA and SERA during the RI, or from the baseline ecological risk assessment (BERA).

### **Record of Decision**

A ROD was completed to present the selected remedy for addressing contaminated shallow groundwater at Site 47 (CH2M HILL, 2011c). The selected remedy for Site 47 is Alternative 2 – Source Zone Treatment using ISCO, MNA, and ICs. The components of this alternative include the following:

- Implementing ISCO using AAP in the source area where CT and PCE are greater than 500 µg/L.
- Using NA processes for the remaining dissolved plume and the source area following the active treatment with AAP.
- Conducting short-term ISCO performance sampling events at baseline (before injection) and 2-, 6-, and 9-month post-ISCO events.
- Conducting long-term groundwater monitoring for an assumed duration of 52 years. The long-term monitoring program would consist of performance monitoring of the ISCO within the source area during the first 2 years, and of the MNA for the remaining 50 years. The cost estimate assumed that the groundwater monitoring would be conducted on a quarterly basis from year 1 to year 3, and annually from year 4 to year 52.
- Enforcing ICs in the form of land and groundwater use restrictions. The site would be designated as a “restricted use” area in the NSF-IH system. This designation would place controls on intrusive activities such as excavation, residential development, or use of groundwater. The restricted-use designation would remain in place until groundwater monitoring indicates that the SRGs have been met.
- Conducting 5-year reviews.

## **2.2.6 Risk Assessment Summary**

### **Human Health Risk Assessment**

As part of the RI, a baseline HHRA was performed for soil (surface soil, and combined surface and subsurface soil), surface water, sediment, concrete, and groundwater to evaluate the current and future effects of constituents in site media on human health. The baseline HHRA for groundwater was updated as part of the FS.

The potential receptors evaluated in the HHRA were as follows:

- For current site uses—adolescent trespasser/visitor (surface soil, surface water, and sediment), industrial worker (surface soil), and other worker (surface water and sediment)

- For potential future site uses—adult, child, and lifetime resident (soil and groundwater), adolescent trespasser/visitor (surface soil, surface water, and sediment), industrial worker (soil), construction worker (soil, concrete, and groundwater), and other worker (surface water and sediment)

The HHRA concluded that under current site use conditions, surface soil does not pose unacceptable risks (both non-cancer and cancer) to adolescent trespassers/visitors or industrial workers, and surface water and sediment do not pose unacceptable risks to adolescent trespassers/visitors and maintenance workers. Under future land use conditions, soil does not pose unacceptable risks (both non-cancer and cancer) to any of the potential receptors. Additionally, exposure to the concrete by construction workers does not result in any unacceptable risks.

The HHRA for groundwater in the FS concluded that under future site use conditions, potable use of shallow groundwater would pose unacceptable risks (both non-cancer and cancer) to residents, and contact with groundwater in an excavation by construction workers would pose unacceptable risks to construction workers.

The main risk drivers in the shallow groundwater are:

- VOCs (primarily 1,2-dichloroethane, CT, chloroform, PCE, TCE) and metals (primarily arsenic, cyanide, iron, thallium, and vanadium)

### Ecological Risk Assessment

A SERA was conducted as part of the Site 47 RI to conservatively estimate the risks the site posed to ecological receptors. The results of the SERA indicated there were potentially unacceptable risks to ecological receptors, which are soil invertebrates and terrestrial wildlife in the upland portion of the site and benthic invertebrates, water column invertebrates, and amphibians in the downgradient stream, from site-related chemicals in surface soils, including VOCs, SVOCs, and metals. Two metals (mercury and silver) and two SVOCs (diethylphthalate and phenanthrene) were identified as constituents of potential concern (COPCs) for sediment in the shallow stream downgradient of the site. Four metals (aluminum, iron, manganese, and zinc) were identified as COPCs for surface water in the stream. No unacceptable risks were identified for upper-trophic-level receptors from exposure to stream sediment or surface water.

A BERA was conducted to collect site-specific risk data and refine the risk estimates for the COPCs identified in the SERA. The methodology and results of the BERA are presented in the BERA report (CH2M HILL, 2006). The results showed that: (1) the COPCs in the surface soil at Site 47 do not pose unacceptable risk to soil invertebrates, birds, and mammals; (2) sediment at the site appears to be toxic to benthic invertebrates; however, the cause of the toxicity did not seem to be related to COPCs identified in the sediment, surface soil, or groundwater at the site; and, (3) the concentrations of aluminum, iron, and manganese in the surface water at the site could pose an unacceptable risk to larval amphibians or aquatic invertebrates; however, the presence of these metals appears to be related to the natural background levels of these metals in soils and groundwater at NSF-IH.

Following the BERA, a supplemental sampling and chemical analysis of site sediments was conducted because of the uncertainty surrounding the toxicity observed in the laboratory bioassays and the potential lack of a connection between the toxicity and site-related chemicals. To address this uncertainty and aid in risk management for the site, five additional sediment samples were collected from the drainage ditch and analyzed for a full suite of analytical parameters. The results of this sampling event are documented in a technical memorandum, *Site 47 Supplemental Baseline Ecological Risk Assessment Investigation Results, Naval Support Facility, Indian Head* (Appendix F of the BERA report; CH2M HILL, 2006). Four pesticide compounds (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and endrin ketone) were detected in the sediment samples at concentrations that exceeded ecological screening values. The detected concentrations were relatively low and did not reflect concentrations expected from potential releases from Site 47. These results suggested that pesticides might be the causal agents responsible for the observed toxicity. In summary, unacceptable risks to potential receptors were identified from exposure to sediment in the drainage ditch; however, these risks are not related to contaminants from Site 47

because the toxicity was not attributed to COPCs identified in the sediment, surface soil, or groundwater at the site.

## **2.3 Conceptual Site Model**

The conceptual site model (CSM) integrates information regarding the physical characteristics of the site, potentially exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify exposure routes and receptors evaluated in the risk assessments. A well-defined CSM allows for a better understanding of the risks at a site and aids in evaluating the potential need for remediation. Following the FS, the CSM in the RI has been updated for the receptors and pathways of the COCs requiring remediation in the shallow groundwater (Figure 3).

### **2.3.1 Potential Source Areas**

As noted earlier, mercuric nitrate was used in Building 856 from 1957 to 1965 as a catalyst in the production of the missile propellant hydrazinium nitroformate and was disposed of at a location near the southeast corner of the building. CT also was used at the site, likely to keep explosives dry (inerting agent) and may have been poured into drains or stored in drums that may have leaked.

### **2.3.2 Release Mechanisms and Transport Pathways**

A transport pathway describes the mechanisms whereby site-related constituents, once released, may be transported from a source area to an exposure medium (such as groundwater) where receptor exposures may occur. The potential transport pathways are identified on Figure 3.

Because human health and ecological COCs were not identified in soil, sediment, surface water, or concrete, and ecological COCs were not identified for the shallow groundwater, the primary mechanisms for human health COCs transport in groundwater from the potential source areas are:

- Infiltration/leaching of constituents from the mercuric nitrate disposal area into the soil and groundwater
- Infiltration/leaching of constituents from Building 856 drains or leaky drums storage areas into the soil and groundwater

### **2.3.3 Human Health Exposure Pathways and Receptors**

Based on previous investigations, soil, sediment, surface water, and concrete do not pose an unacceptable risk to potential receptors at Site 47. The shallow groundwater, however, poses unacceptable risks (both non-cancer and cancer) to future residents if used as a potable source of water, and to construction workers if they come in contact with groundwater in an excavation.

### **2.3.4 Ecological Exposure Pathways and Receptors**

Ecological receptors at Site 47 are soil invertebrates and terrestrial wildlife in the upland portion of the site and benthic invertebrates, water column invertebrates, and amphibians in the downgradient stream. Receptors can be exposed to chemicals via direct contact with abiotic media, ingestion, or trophic transfer through the food chain. Although there are complete exposure pathways for ecological receptors at Site 47 to be potentially exposed to site-related contamination, the results of the BERA indicated that site-related chemicals in surface soil, sediment, surface water, and shallow groundwater do not pose unacceptable risks to ecological receptors.

## **2.4 Problem Definition**

The goal of the Pre-Design Investigation is to provide the necessary data to optimize the treatment system configuration for the full-scale remedy of the shallow groundwater contamination. The specific objectives of the Pre-Design Investigation are:

- Refine the understanding of the post-pilot-study boundary of the source area plume for CT and PCE (500 µg/L isoconcentration line) to determine the actual size of the plume requiring treatment (as part of the full-scale remedy)
- Refine the understanding of the lithology and characterize the vertical distribution of VOCs in the saturated soil within the source area to ensure the treatment configuration is optimized for substrate delivery

The objectives of the baseline and short-term performance monitoring for groundwater are:

- Assess ISCO performance in terms of VOC mass/concentration reductions in groundwater
- Assess ISCO performance in terms of VOC mass reductions in saturated soil
- Demonstrate whether metals are being mobilized downgradient as a result of ISCO
- Determine whether the oxidation processes have ceased at 9 months post-ISCO injections, and the extent to which pre-injection conditions return in groundwater
- Assess the impacts, if any, ISCO has on NA (reductive dechlorination) parameters/conditions in groundwater

The environmental questions/problems to be addressed by the Site 47 Pre-Design Investigation are:

**1. What is the vertical distribution of VOCs in the saturated soil within the source area and subsurface lithology?**

MIP profiling will be conducted at 12 locations in the North Area (Figure 4) and 16 locations in the South Area (Figure 5). The MIP profile results will be used to advance boreholes using DPT at four locations in the North Area and five locations in the South Area. At each boring location, one *in situ* groundwater sample and three saturated soil samples will be collected and sent to an offsite laboratory for VOC analysis. The intervals from which the saturated soil samples are collected will be decided based on the MIP results and the use of field screening tools (PID and color-TEC) during DPT activities. The MIP, PID, color-TEC, DPT split-spoon, and laboratory analyses and results will be used to refine the vertical distribution of VOCs in the saturated soil and understanding of the subsurface lithology.

**2. What is the boundary of the source area plume for CT and PCE (500 µg/L isoconcentration line)?**

The MIP profile and *in situ* groundwater results from the North Area and South Area, as described above, will be used to refine the understanding of the source area plume boundary. The MIP will be used as a field screening tool so the data will be qualitative.

The environmental questions/problems to be addressed by the Site 47 baseline and post-injection sampling are:

**1. What is the baseline (pre-ISCO application) site-wide plume configuration, groundwater geochemistry, and saturated soil geochemistry?**

Before implementing ISCO application, baseline groundwater samples will be collected and analyzed to assess the current site conditions and better understand the current site-wide plume configuration, contaminant concentrations, and existing geochemical properties to help evaluate post-injection conditions and so that effective and optimal conditions are established for microorganisms.

**2. To what degree can the ISCO application decrease the COC concentrations?**

Groundwater samples collected from post-injection performance monitoring wells will be analyzed for the same analytes as the baseline samples. Post-injection performance monitoring will be conducted at 2, 6, 9 months after the oxidant injection. Concentrations of selected VOCs, total and dissolved metals, and subsurface geochemical properties will be examined. A technical memorandum will be prepared following the 9-month performance monitoring event, which will present an evaluation the effectiveness of the ISCO application and the MNA processes in addressing residual groundwater contamination.

**3. Are natural attenuation parameters favorable for attenuation of COCs (do conditions appear to be reducing)?**

Natural attenuation parameters listed in Section 2.5 will be evaluated by weight of evidence following the 9-month performance monitoring event to assess the potential for natural attenuation of COCs to meet remediation goals over time.

**4. Have metals been mobilized downgradient to levels above RSLs?**

Total and dissolved metals will be evaluated, in particular four indicator metals (chromium, lead, cadmium, and nickel), to assess the potential for downgradient migration of metals as a result of the ISCO application. The four site metal COCs will also be evaluated. Research over the last 10 years and field data have shown the likelihood of metals being transported downgradient being very low; however, the data will be collected to confirm this.

## **2.5 Data Quality Objectives/Systematic Planning Process Statements**

### **Who will use the data?**

CH2M HILL, in conjunction with the Tier I Partnering Team (Navy, EPA Region III, and MDE), will use the data collected during the Pre-Design Investigation to finalize the design for the injection. The Tier I Partnering Team will use the baseline and post-injection sampling to assess whether ISCO processes are effectively addressing contamination in the shallow groundwater underlying Site 47. They will also use the data to identify metal mobilization potential.

### **What are the Project Action Limits (PALs)?**

The PALs for the site COCs in the shallow groundwater are provided in Tables A1-1 through A1-4; they are the SRGs listed in the ROD. The SRGs were identified as the highest concentration among the site-specific preliminary remediation goals, facility-wide background concentrations (95 percent upper confidence limit), and State of Maryland or federal groundwater MCLs. As previously noted, soil is not a medium of concern; however, soil samples will be collected for analysis, and the results will be used to measure trends and provide supporting information for the groundwater evaluation (such as rebound potential and back diffusion). Because COCs were not identified for soil, SRGs were not calculated. To evaluate the groundwater COCs in the saturated soil, "evaluation limits" were calculated and are provided in Tables A1-5 through A1-7. The soil evaluation limits were calculated for groundwater VOC COCs only, and were based on conceptual partition coefficient of contaminants between soil organic carbon and water.

Field parameters (dissolved oxygen, oxidation-reduction potential, pH, temperature, specific conductivity, and turbidity), TOC, sulfate, sulfide, nitrate, ferrous iron, ferric iron, methane, ethane, ethene, alkalinity, and qPCR do not have PALs because they do not have a "critical" level upon which decisions will be made; however, the relative values and the changes in the values over time will be used to assess the aquifer conditions before and after treatment and will be used in the overall evaluation of contaminant reduction. Temperature, turbidity, pH, and specific conductivity are only used as purging stabilization indicators and are expected to remain stable within the treatment area. Oxidation-reduction potential and dissolved oxygen are expected to decrease within the treatment area. Ferrous iron and alkalinity are expected to increase within the treatment area.

Results of the waste characterization analyses for IDW generated during the Pre-Design Investigation, baseline sampling, and post-injection sampling will be compared to applicable hazardous waste criteria and disposal facility acceptance criteria for offsite disposal/treatment as appropriate.

### **How will the data be used?**

The data will be used to satisfy the objectives presented in Section 2.4.

## **What types of data are needed? (matrix, target analytes, analytical groups, field screening, onsite analytical or offsite laboratory techniques, sampling techniques)?**

This UFP-SAP provides details for collection and analysis of soil and groundwater samples for Site 47.

During the scoping session (Section 2.1) TCL VOCs were discussed for soil and groundwater sampling. However, the IHIRT later decided that the samples should be analyzed for the select VOC COCs that were identified in the FS. Therefore, soil and groundwater samples collected during the Pre-Design Investigation will be analyzed for nine select VOCs (carbon disulfide, CT, chloroform, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1,2,2-tetrachloroethane, PCE, vinyl chloride [VC], and TCE). Soil samples will also be analyzed for TOC.

Groundwater samples collected during the baseline and post-injection sampling will be analyzed for nine select VOCs (carbon disulfide, CT, chloroform, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1,2,2-tetrachloroethane, PCE, VC, and TCE), total (unfiltered) and dissolved (field-filtered) TAL metals, TOC, sulfate, sulfide, nitrate, ferrous iron, ferric iron, methane, ethane, ethene, alkalinity, qPCR, and persulfate. Although the FS found that the metal COCs are arsenic, iron, thallium, and vanadium, the IHIRT decided to sample for the full list of TAL metals so the results could be used to see how the oxidation affected metal solubility and potential migration. Total and dissolved metals will be analyzed to determine the ratio of metals present in the dissolved phase versus adsorbed to particulate matter in groundwater. These data will be used to evaluate the phase distribution and assess transport of potentially mobilized metals downgradient. Saturated soil samples will be analyzed for nine select VOCs (carbon disulfide, CT, chloroform, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1,2,2-tetrachloroethane, PCE, VC, and TCE), TAL metals, and TOC. The rationale for the sampling design, including matrices, locations, and analytical protocol, is provided in Section 2.7.

IDW samples will be analyzed for Toxicity Characteristic Leaching Procedure, ignitability, corrosivity, and reactivity.

All samples will be collected in general accordance with the standard operating procedures (SOPs) listed in the Field SOP Reference Table (Section 3.2).

## **How “good” must the data be to support the environmental decision?**

- The field activities associated with this investigation will support the remedial action design and effectiveness evaluation; therefore, the data quality must be adequate to make the associated determinations. Because groundwater, not soil, is the media of concern at Site 47, the soil data collected will be utilized to measure trends and provide supporting information for the groundwater evaluation. Ensuring data are adequate for this purpose will be accomplished by employing appropriate sampling methods, sample handling and shipping procedures, analytical protocols, identifying PALs, and validating the resulting data, including QA/QC samples to verify proper sampling and analysis protocol. Each of these is further discussed below.
- **Data Validation** – Validation of data increases the level of confidence in a data set for a particular data use. The particular type and level of validation necessary to achieve acceptable confidence is subjective, and the appropriate type and level of data validation is not an absolute. Rather, the level of validation is specific to the data use and data user. For this data set, analyses for potential contaminants will be validated by CH2M HILL using guidance from the validation criteria outlined by EPA in conjunction with the specific QA/QC criteria presented in Appendix A. The validation criteria and guidance documents are listed in the Data Verification and Validation (Steps I and IIa/IIb) Process Table. These documents will help the validator create a thorough and systematic approach to the validation process. The data validator will also recalculate 10 percent of the results from the raw laboratory data, which may identify laboratory errors in identification or quantification, if present. The field measurements and MIP data are screening level data and therefore will not be validated; however they will be collected in accordance with SOPs specific to each analysis.
- **QA/QC Samples** – During the various investigations, QA/QC samples will be collected in the field along with the various soil and groundwater samples as a check on sampling and analytical protocol. Like data validation, the appropriate type and quantity of QA/QC samples is not an absolute. For these investigations, field

duplicates will be collected at a frequency of 1 per 10 field samples. Field duplicates help assess sample collection techniques and laboratory precision. Matrix spike/matrix spike duplicates (MS/MSDs) will be collected at a frequency of 1 pair per 20 field samples. The frequency is such that there is one MS/MSD pair per laboratory analytical batch. MS/MSD samples are often required by the analytical method and/or data validation guidance. Equipment blanks are collected at a frequency of one per day per type of decontaminated equipment. Equipment blanks help assess equipment decontamination techniques and identify when contamination may have been carried over from one sample location to another. It is important to maintain this equipment blank frequency to not associate too many locations with a potentially contaminated equipment blank. Field blanks are collected at a frequency of one per week and are used to assess potential contamination from ambient field conditions.

### **How will data be used when the limit of detection (LOD) is greater than the PAL?**

- The Reference Limits and Evaluation Tables (Tables A1-1 thru A1-7) present analytical methodology and limits. In addition to listing the particular analytes, PALs, and limits, this table identifies where LODs are greater than PALs. Although this information was taken into consideration when planning the analytical protocol for the site and could lead to some uncertainty, it does not prevent conclusions from being drawn with respect to the objectives of the investigations for the following reasons:
  - If a particular analyte has an LOD greater than a screening level and there are sufficient other analytes in the same constituent group that would likely be detected in the event of a release with an LOD less than the screening values, then decisions for further action at the site can be made with sufficient confidence.
  - Even though some LODs are greater than the respective PALs, detection limits are closer to and could be less than the applicable PALs. The laboratory instrumentation would likely detect a constituent if present at a concentration greater than its detection limit; such a result would be reported as estimated because it is less than the limit of quantitation (LOQ).
  - Soil data collected during the investigation will be used to measure trends and provide supporting information for the groundwater evaluation. Therefore, the sensitivity issues regarding 1,2-DCA and VC in soil are minimized in terms of detection values.

### **How much data should be collected (number of samples for each analytical group, environmental media)?**

Detailed information on matrices to be sampled, number of samples to collect, and analyses for each sample are provided in the Analytical Groups table (Section 2.7.4). The quantities and types of QA/QC samples are detailed in the Sample Details Table (Section 3.3). General information is presented below:

- Pre-Design Investigation – MIP profiles will be collected at 12 locations in the North Area and 16 locations in the South Area (Figures 4 and 5). In the North Area, DPT will be used at 4 locations to collect 4 *in situ* groundwater samples (1 sample per borehole) and 12 saturated soil samples (3 samples per borehole). In the South Area, DPT will be used at 5 locations to collect 5 *in situ* groundwater samples (1 sample per borehole) and 15 saturated soil samples (3 samples per borehole). All samples will be analyzed for select VOCs, which are the groundwater COCs requiring remediation (carbon disulfide, CT, chloroform, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1,2,2-tetrachloroethane, PCE, and TCE), and VC, which is an intermediate breakdown product of PCE and TCE degradation. Soil samples will also be analyzed for TOC.
- Eight new 2-inch-diameter permanent monitoring wells will also be installed—four in the North Area and four in the South Area.
- Baseline, 2-month post-injection, 6-month post-injection, and 9-month post-injection Investigations - Twenty-two groundwater samples (14 from existing wells and 8 from new wells) will be analyzed for select VOCs (carbon disulfide, CT, chloroform, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1,2,2-tetrachloroethane, PCE, VC, and TCE), total (unfiltered) and dissolved (field-filtered) TAL metals, TOC, sulfate, sulfide, nitrate, ferrous

iron, ferric iron, methane, ethane, ethene, alkalinity, qPCR, and persulfate. Before sampling begins, groundwater levels will be measured in all monitoring wells to obtain the shallow water table elevation and to assess flow direction in the vicinity of Site 47.

- Eight saturated soil samples will be collected during the baseline and 9-month post injection sampling using DPT. These samples will be analyzed for select VOCs (carbon disulfide, CT, chloroform, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1,2,2-tetrachloroethane, PCE, VC, and TCE), TAL metals, and TOC.

The Reference Limits and Evaluation Tables (Tables A1-1 thru A1-7) present the constituents to be analyzed for and the associated quantitation limits (QLs) for the Site 47 sampling.

#### **Where, when, and how should the data be collected/generated?**

- Pre-Design Investigation sampling will be performed during the Site 47 Pre-Design field sampling event, tentatively scheduled for spring of 2012.
- Baseline sampling will be performed before ISCO injection activities, which is tentatively scheduled for summer of 2012. Post-injection short-term monitoring sampling events will occur after completion of ISCO injection.
- All sampling will be performed in general accordance with procedures described in the SOPs listed in the Field SOPs Reference table.

#### **Who will collect and generate the data? How will the data be reported?**

- A CH2M HILL field team will collect the samples during the Site 47 Pre-Design Investigation, baseline, and post-injection sampling events.
- Samples will be shipped for analysis via overnight courier to an offsite Navy-approved laboratory under subcontract to CH2M HILL.
- All analytical data will be submitted to CH2M HILL. Once received and reviewed by CH2M HILL, all analytical data will be validated by CH2M HILL, with the exception of the field measurements and MIP data, as noted previously.
- Field data such as field observations will also be generated during the Site 47 sampling events and recorded in a field notebook.
- All analytical data from the Pre-Design Investigation will be presented in a technical memorandum to be prepared and submitted to the Navy as a preliminary draft for review before distribution to EPA and MDE for regulatory review and approval. The final approved report will be placed in the Administrative Record and will be publicly available.
- All analytical data from the baseline and post-injection sampling will be compiled and presented in a technical memorandum to be prepared and submitted to the Navy as a preliminary draft for review before distribution to EPA and MDE for regulatory review and approval. The final approved report will be placed in the Administrative Record and will be publicly available.

#### **How will the data be archived?**

Data will be archived according to procedures dictated via the CLEAN program contract. Data will be uploaded to the Navy Installation Restoration Information Solution for use and archiving by the Navy. At the end of the project, paper copies of archived laboratory data and validation reports will be returned to the Navy.

#### **Project Quality Objectives listed in the form of if/then qualitative and Quantitative statements.**

The project quality objectives are shown on Figure 6 in the form of a decision tree.

For the Pre-Design Investigation, MIP profiles will be collected at 12 locations in the North Area and 16 locations in the South Area. The results will be used to select the DPT sampling locations. The *in situ* groundwater results

will be compared to the Source Plume boundary concentration of 500 µg/L. If results are below 500 µg/L, then the Source Area plume boundary will decrease. If the results are above 500 µg/L, the Source Area plume boundary will not change. The soil data will not be used to revise the Source Area boundary but rather to measure trends and support the groundwater evaluation.

## **2.6 Field QC Samples**

## 2.6.1 Table 2-1 Measurement Performance Criteria Table – Field QC Samples

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** VOC

**Concentration Level:** Low (SW-846 8260B)

QC Sample <sup>2</sup>	Analytical Group <sup>1</sup>	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Duplicate	VOC	One per 10 field samples	Precision	%RPD ≤20%	S & A
Equipment Rinsate Blank	VOC	One per day	Bias / Contamination	Same as method blank. Refer to Table A-3-1.	S
Trip Blank	VOC	One per cooler	Bias / Contamination	Same as method blank.	S & A
Temperature Blank	VOC	One per cooler	Accuracy / Representativeness	2-6°C	S

<sup>1</sup>If information varies within an analytical group, separate by individual analyte.

<sup>2</sup>MS/MSD is described on Table A-3-1.

## 2.6.2 Table 2-2 Measurement Performance Criteria Table – Field QC Samples

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** METAL, FMETAL

**Concentration Level:** Low (SW-846 6020A)

QC Sample <sup>2</sup>	Analytical Group <sup>1</sup>	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Duplicate	METAL, FMETAL	One per 10 field samples	Precision	%RPD ≤20%	S & A
Equipment Rinsate Blank	METAL, FMETAL	One per day	Bias / Contamination	Same as method blank. Refer to Table A-3-2.	S
Temperature Blank	METAL, FMETAL	One per cooler	Accuracy / Representativeness	2-6°C	S

<sup>1</sup>If information varies within an analytical group, separate by individual analyte.

<sup>2</sup>MS/MSD is described on Table A-3-2.

## 2.6.3 Table 2-3 Measurement Performance Criteria Table – Field QC Samples

**Matrix:** Groundwater

**Analytical Group:** WCHEM

**Concentration Level:** Medium (EPA 300.0, SM4500-S2-F, RSK-175, SW-846 9060, SM2320B)

QC Sample	Analytical Group <sup>1</sup>	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Temperature Blank	WCHEM	1 per cooler	Representativeness	2-6°C	S

<sup>1</sup>If information varies within an analytical group, separate by individual analyte.

## 2.6.4 Table 2-4 Measurement Performance Criteria Table – Field QC Samples

**Matrix:** Groundwater

**Analytical Group:** MICRO

**Concentration Level:** Low (qPCR)

QC Sample	Analytical Group <sup>1</sup>	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Temperature Blank	MICRO	1 per cooler	Representativeness	2-6°C	S

<sup>1</sup>If information varies within an analytical group, separate by individual analyte.

## 2.6.5 Table 2-5 Measurement Performance Criteria Table – Field QC Samples

**Matrix:** Surface Soil and Subsurface Soil

**Analytical Group:** VOC

**Concentration Level:** Low (SW-846 8260B)

QC Sample <sup>2</sup>	Analytical Group <sup>1</sup>	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Duplicate	VOC	One per 10 field samples	Precision	%RPD ≤30%	S & A
Equipment Rinsate Blank	VOC	One per day	Bias / Contamination	Same as method blank. Refer to Table A-3-5.	S
Trip Blank	VOC	One per cooler	Bias / Contamination	Same as method blank.	S & A
Temperature Blank	VOC	One per cooler	Accuracy / Representativeness	2-6°C	S

<sup>1</sup>If information varies within an analytical group, separate by individual analyte.

<sup>2</sup>MS/MSD is described on Table A-3-5.

## 2.6.6 Table 2-6 Measurement Performance Criteria Table – Field QC Samples

**Matrix:** Surface Soil and Subsurface Soil

**Analytical Group:** METAL

**Concentration Level:** Low (SW-846 6020A)

QC Sample <sup>2</sup>	Analytical Group <sup>1</sup>	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Duplicate	METAL	One per 10 field samples	Precision	%RPD ≤30%	S & A
Equipment Rinsate Blank	METAL	One per day	Bias / Contamination	Same as method blank. Refer to Table A-3-6.	S
Temperature Blank	METAL	One per cooler	Accuracy / Representativeness	2-6°C	S

<sup>1</sup>If information varies within an analytical group, separate by individual analyte.

<sup>2</sup>MS/MSD is described on Table A-3-6.

## 2.6.7 Table 2-7 Measurement Performance Criteria Table – Field QC Samples

**Matrix:** Surface Soil and Subsurface Soil

**Analytical Group:** WCHEM

**Concentration Level:** Low (Walkley Black)

QC Sample	Analytical Group <sup>1</sup>	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Temperature Blank	WCHEM	One per cooler	Accuracy / Representativeness	2-6°C	S

<sup>1</sup> If information varies within an analytical group, separate by individual analyte.

## 2.7 Sampling Design and Rationale

### 2.7.1 General Approach

The sampling design and rationale were based on previous investigations at Site 47 as well as discussions held by the Tier I Partnering Team during the project scoping session. The Tier I Team agreed that soil and groundwater samples should be collected during the Pre-Design Investigation to prepare for the ISCO implementation, and sample locations presented in this UFP-SAP were selected by the team to provide sufficient coverage of the site. The Tier I Team also agreed that soil and groundwater samples should be collected during the baseline and post-injection sampling to evaluate the effectiveness of the ISCO implementation, and sample locations presented in this UFP-SAP were selected by the team to provide sufficient coverage of the site. The sampling will be conducted in multiple areas (Figures 4 and 5) as previously discussed.

### 2.7.2 Sampling Rationale

The data from the Pre-Design Investigation will be used to refine the design for ISCO application at the site. The MIP locations are spaced throughout the site to refine the understanding of the soil lithology, as well as the vertical distribution of VOCs in the subsurface (Figures 4 and 5). DPT locations will be selected based on Tier I partnering team review of the MIP data.

The data from the baseline and post-injection sampling will be used to evaluate the effectiveness of the ISCO application at the site.

### 2.7.3 Sample Matrices

Sample matrices for the Pre-Design Investigation are limited to saturated soil and groundwater to determine the size of the plume requiring treatment for the ISCO application. Sample matrices are also limited to saturated soil and groundwater for the baseline and post-injection sampling to evaluate the effectiveness of the ISCO application.

### 2.7.4 Analytical Groups

Analyses for the various media will consist of the following:

Matrix	Depth of Samples	Analysis	Method	Number of Samples	Rationale	Sampling Strategy
Subsurface Soil	TBD	Select VOCs and TOC	8260B, Walkley Black	27	Better define the boundary of the source area plume to determine the extent of the area requiring treatment.	Subsurface soil samples and <i>in-situ</i> groundwater samples will be collected using direct push sampling methods.
<i>In-situ</i> Groundwater	TBD	Select VOCs	8260B	9		
Groundwater (from monitoring wells)	N/A	Select VOCs, total and dissolved TAL metals	8260B, 6020A,	88 (22 samples per event)	Assess ISCO performance.	The monitoring well will be purged before sampling. The groundwater sample will be collected using a low-flow sampling technique.
Groundwater (from monitoring wells)	N/A	TOC, nitrate, methane, ethane, ethene, alkalinity, and qPCR	9060, EPA 300.0, RSK-175, SM2320B, qPCR	22 (11 samples in baseline and 9-month event)	Assess ISCO performance.	The monitoring well will be purged before sampling. The groundwater sample will be collected using a low-flow sampling technique.

Matrix	Depth of Samples	Analysis	Method	Number of Samples	Rationale	Sampling Strategy
Groundwater (from monitoring wells)	N/A	Sulfate	EPA 300.0	64 (16 samples per event)	Assess ISCO performance.	The monitoring well will be purged before sampling. The groundwater sample will be collected using a low-flow sampling technique.
Groundwater (from monitoring wells)	N/A	Sulfide	SM4500-S2-F	32 (16 samples in baseline and 9-month event)	Assess ISCO performance.	The monitoring well will be purged before sampling. The groundwater sample will be collected using a low-flow sampling technique.
Groundwater (from monitoring wells)	N/A	Ferrous iron and ferric iron	Field test kits	22 (11 samples in baseline and 9-month event)	Assess ISCO performance.	The monitoring well will be purged before sampling. The groundwater sample will be collected using a low-flow sampling technique.
Groundwater (from monitoring wells)	N/A	Persulfate	Field test kit	64 (16 samples per event)	Assess ISCO performance.	The monitoring well will be purged before sampling. The groundwater sample will be collected using a low-flow sampling technique.
Subsurface Soil	TBD	Select VOCs, TAL metals, and TOC	8260B	16 (8 samples per event)	Assess ISCO performance.	Subsurface soil samples and <i>in-situ</i> groundwater samples will be collected using DPT sampling methods.
Groundwater (Comprehensive round of groundwater elevation measurements)	N/A	N/A	N/A	0	Determine the groundwater flow direction at the site.	Collect round of groundwater elevations from 22 monitoring wells.

## 2.7.5 Sampling Frequency and Seasonal Considerations

One round of sampling will be conducted during the Pre-Design Investigation. This sampling is currently scheduled to be performed in the spring 2012.

Four rounds of sampling (baseline, 2-month post injection, 6-month post injection, and 9-month post injection) will be conducted to evaluate the effectiveness of the ISCO application. The results of the bench-scale study and pilot study indicated that the longevity of activated persulfate is less than 2 months. Therefore, sampling after 2 months will confirm activated persulfate's longevity and determine short-term ISCO performance. Sampling at 6 months will provide information on the continuing effectiveness of ISCO and on whether bioprocesses have started to reestablish. The data for 9 months sampling will provide information on the following: 1) amount of reduction in VOC/mass concentrations in saturated soil and groundwater; 2) whether NA parameters are

favorable for biodegradation; 3) whether metals have mobilized downgradient; and 4) whether activated persulfate has been fully consumed. Baseline sampling is currently scheduled to occur in the spring of 2012. Post-injection sampling will be scheduled following the ISCO application.

## **2.8 Data Management**

### **2.8.1 Analysis Tasks**

The analytical laboratory will process and prepare samples for analyses and will analyze all samples in accordance with the Sample Details Table.

### **2.8.2 QC Tasks**

- Implement SOPs for field and laboratory activities being performed
- Collect QC samples as described the Laboratory QC Samples Table.

### **2.8.3 Secondary Data**

- None

### **2.8.4 Data Validation, Review, and Management Tasks**

- CH2M HILL will perform data validation in accordance with the Data Verification and Validation (Steps I and IIa/IIb) Process Table
- Incorporate validated data into the Navy Installation Restoration Information Solution database.

### **2.8.5 Documentation and Reporting**

- All analytical data and validation reports from the Pre-Design Investigation will be presented in a technical memorandum.
- All analytical data and validation reports from the baseline and post-injection sampling will be compiled and presented in a technical memorandum.

### **2.8.6 Data Tracking, Storage, Archiving, Retrieval and Security**

- Records will be maintained and archived in accordance with the Navy CLEAN program contract.
- Tracking, storage, and archiving will be performed by the PDM. The person ultimately responsible for all these activities is the CH2M HILL PM.

## 2.9 Data Verification and Validation (Steps I and IIa/IIb) Process Table

Data Review Input	Description	Responsible for Verification/Validation	Internal / External <sup>1</sup>
Field Notebooks	Field notebooks will be reviewed internally and placed into the project file for archival at project closeout.	FTL (TBD)/CH2M HILL	Internal
Chains of Custody and Shipping Forms	Chain-of-custody (CoC) forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the CoC will be initialed by the reviewer, a copy of the CoC retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	FTL (TBD)/CH2M HILL Project PDM: Hillary Ott/CH2M HILL	Internal / External
Sample Condition upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the project PDM in the form of laboratory logins.	Project PDM: Hillary Ott/CH2M HILL	External
Documentation of Laboratory Method Deviations	Laboratory method deviations will be discussed and approved by the Project Chemist. Documentation will be incorporated into the case narrative which becomes part of the final hardcopy data package.	Project Chemist: Juan Acaron/CH2M HILL	Internal
Electronic Data Deliverables	Electronic data deliverables will be compared against hardcopy laboratory results (10% check).	Project PDM: Hillary Ott/CH2M HILL	External
Case Narrative	Case narratives will be reviewed by the data validator during the data validation process. This is verification that they were generated and applicable to the data packages.	Data Validator: Herb Kelly/CH2M HILL	External
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Laboratory QA Officer (Environmental Conservation [ENCO] Laboratories)	Internal
Laboratory Data	The data will be verified for completeness by an Project Data Manager (PDM) specialist.	Project PDM: Hillary Ott/CH2M HILL	External
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the site file. If CAs are required, a copy of the documented CA taken will be attached to the appropriate audit report in the QA site file. Periodically, and at the completion of site work, site file audit reports and CA forms will be reviewed internally to ensure that all appropriate CAs have been taken and that corrective action reports are attached. If CAs have not been taken, the site manager will be notified to ensure action is taken.	Project Manager: Margaret Kasim/CH2M HILL Project Chemist: Juan Acaron/CH2M HILL	Internal / External
CA Reports	CA reports will be reviewed by the Project Chemist or PM and placed into the project file for archival at project closeout.	PM: Margaret Kasim /CH2M HILL Project Chemist: Juan Acaron/CH2M HILL	External

## 2.9 Data Verification and Validation (Steps I and IIa/IIb) Process Table

Data Review Input	Description	Responsible for Verification/Validation	Internal / External <sup>1</sup>
Laboratory Methods	Ensure the laboratory analyzed samples using the correct methods.	Project Chemist: Juan Acaron/CH2M HILL	External
TCL and TAL	Ensure the laboratory reported all analytes from each analysis group as per Table A1.	Project Chemist: Juan Acaron/CH2M HILL	External
Reporting Limits (RLs)	Ensure the laboratory met the project-designated QLs as per Table A1. If QLs were not met, the reason will be determined and documented.	Project Chemist: Juan Acaron/CH2M HILL	External
Laboratory SOPs	Ensure that approved analytical laboratory SOPs were followed.	Data Validator: Herb Kelly/CH2M HILL	External
Sample Chronology	Holding times from collection to extraction or analysis and from extraction to analysis will be considered by the Data Validator during the data validation process.	Data Validator: Herb Kelly/CH2M HILL	External
Raw Data	10 percent review of raw data to confirm laboratory calculations.	Data Validator: Herb Kelly/CH2M HILL	External
Onsite Screening	All non-analytical field data will be reviewed against Quality Assurance Project Plan requirements for completeness and accuracy based on the field calibration records.	FTL(TBD)/CH2M HILL	Internal
Documentation of Method QC Results	Establish that all required QC samples were run and met limits.	Data Validator: Herb Kelly/CH2M HILL	External
Documentation of Field QC Sample Results	Establish that all required Quality Assurance Project Plan QC samples were run and met limits.	Project Chemist: Juan Acaron/CH2M HILL Data Validator: Herb Kelly/CH2M HILL	External
Analytical Data Validation (VOC)	Analytical methods and laboratory SOPs, as presented in this UFP-SAP, will be used to evaluate compliance against QA/QC criteria. QA/QC criteria for field QC samples are presented in Table 2. Target compound lists, LOQs, LODs, and DLs are presented in Table A1. QA/QC criteria for calibrations are presented in each laboratory SOP (referenced in Table A2). QA/QC criteria for laboratory QC samples are presented in Table A3. Data may be qualified if QA/QC exceedances have occurred. Data qualifiers will be those presented in <i>Region III Modifications to National Functional Guidelines for Organic Data Review</i> (EPA, 1994). Guidance and qualifiers from <i>EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review</i> (EPA, 1999) may also be applicable. 100% of the VOC data generated will undergo analytical data validation. Of the 100% validated, 10% of results will be re-calculated from the raw data to verify calculations.	Data Validator: Herb Kelly/CH2M HILL	External

## 2.9 Data Verification and Validation (Steps I and IIa/IIb) Process Table

Data Review Input	Description	Responsible for Verification/Validation	Internal / External <sup>1</sup>
Analytical Data Validation (METAL or FMETAL)	Analytical methods and laboratory SOPs, as presented in this UFP-SAP, will be used to evaluate compliance against QA/QC criteria. QA/QC criteria for field QC samples are presented in Table 2, target analyte lists, LOQs, LODs, DLs, and limits for precision and accuracy are presented in Table A1, QA/QC criteria for calibrations are presented in each laboratory SOP (referenced in Table A2). QA/QC criteria for laboratory QC samples are presented in Table A3. Data may be qualified if QA/QC exceedances have occurred. Data qualifiers will be those presented in <i>Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses</i> (EPA 1993). 100% of the METAL and FMETAL data generated will undergo analytical data validation. Of the 100% validated, 10% of results will be re-calculated from the raw data to verify calculations.	Data Validator: Herb Kelly/CH2M HILL	External
Analytical Data Validation (WCHEM and MICRO)	WCHEM and MICRO are subject to the verification procedures specified in this table. The case narratives will be read, any issues will be investigated, and the impact (if any) on data quality or data usability will be discussed with the project team.	Project Chemist: Juan Acaron/CH2M HILL	External

<sup>1</sup>Internal / External is with respect to the data generator.

## SECTION 3

# 3 Field Project Implementation

## 3.1 Field Project Instructions

### 3.1.1 Pre-Sampling Tasks

Before the Pre-Design Investigation fieldwork begins, utility locating, MIP, DPT, drilling, and monitoring well surveying subcontractors will be procured. Before the baseline and 9-month post injection fieldwork begins, utility locating and DPT subcontractors will be procured. Intrusive activities are not planned for the 2-month and 6-month post-injection events. Also, the FTL, Site Safety Coordinator, and other field team members will be identified to complete the field sampling events at Site 47.

### 3.1.2 Sampling Tasks

Applicable SOPS for project tasks outlined in this section are listed on the Field SOPS Reference Table.

#### Pre-Design Investigation

##### Mobilization

Following approval of this UFP-SAP, CH2M HILL will begin mobilization activities for the Pre-Design Investigation. Before mobilization, all field team members will review this UFP-SAP and the project-specific HASP. A field team kickoff meeting will be held to ensure that personnel are familiar with the scope of field activities and safety issues. Mobilization activities will include coordination with Base personnel and the preparation of field equipment.

##### Utility Location

Before mobilizing the MIP subcontractor, the field team will mark all sample locations using a portable global positioning system (GPS) unit. A Comprehensive Work Approval Process will be obtained from NSF-IH, and a third-party utility locating subcontractor will clear all sampling locations for underground utilities and/or anomalies.

##### Sample Collection

In general, work will be performed in Level D personal protective equipment (PPE), which includes safety glasses, safety-toed boots, and impermeable gloves. Upgrades to higher levels of PPE will be presented in the HASP that will be prepared as a part of mobilization efforts.

Twelve MIP profiles will be obtained from locations in the North Area of Site 47 (Figure 4). Based on these results, four DPT boring locations will be chosen. A total of 4 *in situ* groundwater samples will be collected, 1 from each boring, and 12 saturated soil samples will be collected, 3 from each boring. Intervals from below the water table which the saturated soil samples will be collected will be decided based on the MIP results and the use of field screening tools (PID and color-TEC) during DPT activities.

Sixteen MIP profiles will be obtained from locations in the South Area of Site 47 (Figure 5). Based on these results, five DPT boring locations will be chosen. Five *in situ* groundwater sampling will be collected, 1 from each boring, and 15 saturated soil samples will be collected, 3 from each boring. Intervals from below the water table which the saturated soil samples will be collected will be decided based on the MIP results and the use of field screening tools (PID and color-TEC) during DPT activities.

All samples will be collected and analyzed as outlined on the Sample Details Table (Section 3.3). All relevant site-specific observations, onsite conditions, and sampling activities will be recorded in the field log book as described in the SOPS. All samples will be collected in laboratory-prepared sampling containers, packed on ice, and shipped overnight to an offsite laboratory every evening. All new MIP and DPT sample locations will be surveyed using a GPS unit.

Eight permanent 2-inch-diameter monitoring wells will be installed using DPT—four in the North Area and four in the South Area. The locations of these monitoring wells will be selected based on MIP and DPT sample results. The new monitoring wells will be screened across the shallow water table, which ranges from approximately 34.4 feet to 37.0 feet above mean sea level. These monitoring wells will then be developed. The newly installed monitoring well locations and elevations will be surveyed by a Maryland-licensed surveyor.

### **Equipment Decontamination**

All non-disposable sampling equipment will be decontaminated before use and immediately after each use as described in the SOPs. Equipment will be decontaminated with alternating rinses of deionized water, phosphate-free laboratory detergent, and methanol, and allowed to dry between each use. Disposable equipment, such as the acetate liners for direct-push soil sampling, will be disposed of immediately following use.

### **IDW Handling**

IDW generated during the soil and groundwater sampling will include purge water, soil cuttings, and solutions used to decontaminate non-disposable sampling equipment. This IDW will be stored in U.S. Department of Transportation (DOT)-approved 55-gallon drums, at the approved IDW staging location. One solid and one liquid sample will be characterized for appropriate offsite disposal. IDW will be removed from the site within 90 days of generation.

### **Quality Control**

QC samples will be collected as outlined on the Sample Details Table.

### **Baseline and Post-Injection Activities**

#### **Mobilization**

Upon the approval of the ISCO implementation design, CH2M HILL will begin mobilization activities for the baseline sampling. Following baseline sampling, CH2M HILL will begin mobilization activities 2 months, 6 months, and 9 months after the ISCO application has occurred.

Before mobilization for each event, all field team members will review this UFP-SAP and the project-specific HASP. A field team kickoff meeting will be held to ensure that personnel are familiar with the scope of field activities and safety issues. Mobilization activities will include coordination with Base personnel and the preparation of field equipment.

#### **Utility Location**

Before mobilizing the DPT subcontractor during the baseline and 9-month post injection sampling events, the field team will mark all sample locations using a portable GPS unit. A dig permit will be obtained from NSF-IH, and a third-party utility locating subcontractor will clear all sampling locations for underground utilities and/or anomalies.

#### **Sample Collection**

In general, work will be performed in Level D PPE, which includes safety glasses, safety-toed boots, and impermeable gloves. Upgrades to higher levels of PPE will be presented in the HASP that will be prepared as a part of mobilization efforts.

Before sampling, groundwater levels will be measured in all monitoring wells to obtain the shallow water table elevation and to assess flow direction in the vicinity of Site 47. During each round of sampling, 22 groundwater samples will be collected using a peristaltic pump following the low-flow sampling protocol described in the SOPs. Water quality parameters will be measured and stabilization readings recorded and met before samples are collected.

During the baseline sampling event and the 9-month post injection sampling event, eight saturated soil samples will be collected using a DPT rig from locations at Site 47 in general accordance with the SOPs. Subsurface soil samples will be collected from the interval below the water table that exhibits the maximum PID reading.

All samples will be collected and analyzed as outlined on the Sample Details Table. All relevant site-specific observations, onsite conditions, and sampling activities will be recorded in the field logbook as described in the SOPs. All samples will be collected in laboratory-prepared sampling containers, packed on ice, and shipped overnight to an offsite laboratory every evening. Dissolved metal samples will be field-filtered. All new soil sample locations will be surveyed using a GPS unit.

### Equipment Decontamination

All non-disposable sampling equipment will be decontaminated before use and immediately after each use as described in the SOPs. Equipment will be decontaminated with alternating rinses of deionized water, phosphate-free laboratory detergent, and methanol, and allowed to dry between each use. The water level indicator will be scrubbed with deionized water between each measurement. Disposable equipment, such as tubing for low-flow sampling and acetate liners for direct-push soil sampling, will be disposed of immediately following use.

### IDW Handling

IDW generated during the soil and groundwater sampling will include purge water, soil cuttings, and solutions used to decontaminate non-disposable sampling equipment. This IDW will be stored in DOT-approved 55-gallon drums, at the approved IDW staging location. One solid and one liquid sample will be characterized for appropriate offsite disposal. IDW will be removed from the site within 90 days of generation.

### Quality Control

QC samples will be collected as outlined on the Sample Details Table.

## 3.2 Field SOPs Reference Table

Reference Number	Title, Revision Date and / or Number	Originating Organization of SOP	Equipment Type	Modified for Project Work?	Comments
SOP B.01	Equipment Blank and Field Blank Preparation, reviewed 5/2011	CH2M HILL	Sample bottles, gloves, blank liquid, preservatives	No	
SOP B.02	Chain-of-Custody (CoC), reviewed 5/2011	CH2M HILL	CoC	No	
SOP B.03	Decontamination of Personnel and Equipment, reviewed and revised 5/2011	CH2M HILL	Deionized water, distilled water, potable water, Liquinox, plastic pails or tubs, 55-gallon drum, gloves, decon pad	No	
SOP B.04	Decontamination of Drilling Rigs and Equipment, reviewed 5/2011	CH2M HILL	Portable steam cleaner, potable water, Liquinox, buckets, brushes, distilled water, methanol, American Society for Testing and Materials Type-II water, aluminum foil	No	
SOP B.05	Direct-Push Soil Sample Collection, reviewed 5/2011	CH2M HILL	Truck-mounted hydraulic percussion hammer, sampling rods, sampling tubes and acetate liners, pre-cleaned sample containers and stainless steel sampling implements	No	

Reference Number	Title, Revision Date and / or Number	Originating Organization of SOP	Equipment Type	Modified for Project Work?	Comments
SOP B.06	Homogenization of Soil and Sediment Samples, reviewed 5/2011	CH2M HILL	Sample containers, stainless steel spoons or spatulas, stainless steel pans	No	
SOP B.07	Preparing Field Log Books, reviewed 5/2011	CH2M HILL	Logbook, indelible pen	No	
SOP B.08	Low-Flow Groundwater Sampling from Monitoring Wells, reviewed and revised 5/2011	CH2M HILL	Water level meter, groundwater pump, water quality meter	No	
SOP B.09	MultiRAE Photoionization Detector, reviewed 5/2011	CH2M HILL	MultiRAE, calibration gas	No	
SOP B.10	Soil Sampling, reviewed and revised 5/2011	CH2M HILL	Stainless steel trowel, shovel, scoop, coring device, hand auger, etc; stainless steel split-spoon samplers, thin-walled sampling tubes, drilling rig or soil-coring rig, stainless steel pan or bowl, sample containers	No	
SOP B.11	Soil Sampling for volatile organic compounds (VOCs), reviewed 12/2011	CH2M HILL	Terra Core Sampler	No	
SOP B.12	Locating and Clearing Underground Utilities, reviewed 5/2011	CH2M HILL	Magnetic field methods, optical methods, ground-penetrating radar, electromagnetic induction	No	
SOP B.13	Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, Oxidation-Reduction Potential, and Temperature using the Horiba U-22 with Flow-through Cell, reviewed 5/2011	CH2M HILL	Horiba U-22 water quality meter with flow-through cells, distilled water in squirt bottle, Horiba U-22 autocalibration standard solution	No	
SOP B.14	Water-Level Measurements, reviewed 5/2011	CH2M HILL	Electronic water-level meter with 100-foot tape, interface probe	No	
SOP B.15	Packaging and Shipping Procedures for Low-Concentration Samples; reviewed 5/2011	CH2M HILL	Lab-supplied coolers	No	
SOP B.16	Disposal of Waste Fluids and Solids, reviewed 5/2011	CH2M HILL	DOT-approved 55-gallon steel drums or Baker tanks, funnel for transferring liquid into drum, tools for securing drum lids, labels, paint/marketing pens, plastic sheets	No	
SOP B.17	Civil Surveying, reviewed 5/2011	CH2M HILL	Logbook, 20-second or better theodolite or transit, GPS unit, electronic distance meter	No	

### 3.3 Field Project Implementation

#### 3.3.1 Field Project Instructions (AQ, GW)

##### Sample Details

<p>Navy CLEAN 8012 CTO-JU05          NSF Indian Head Site 47          Pre-Design Investigation</p> <p>ENCO Laboratories          Attn: Sample Receiving          10775 Central Port Drive          Orlando, FL 32824</p> <p>POC: Ronnie Wambles          (407) 826-5314</p>						Analyze Group	VOC
						Preparation and Analytical Method	SW-846 8260B
						Analytical Laboratory	ENCO Laboratories - Orlando
						Analytical SOP Reference	VGCMS-05
						Data Package Turnaround Time	21 Calendar-day
						Container Type	3 x 40mL vials
						Volume Required	40mL
						Preservative	zero-headspace, HCl to pH < 2, (4±2) °C
						Holding Time (Preparation/analyze)	14 days to analyze
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval	
				X	Y		
Site 47	GW	IS47GW43	IS47GW43MMYY			TBD	X
Site 47	GW	IS47GW44	IS47GW44MMYY			TBD	X
Site 47	GW	IS47GW45	IS47GW45MMYY			TBD	X
Site 47	GW	IS47GW46	IS47GW46MMYY			TBD	X
Site 47	GW	IS47GW47	IS47GW47MMYY			TBD	X
Site 47	GW	IS47GW48	IS47GW48MMYY			TBD	X
Site 47	GW	IS47GW49	IS47GW49MMYY			TBD	X
Site 47	GW	IS47GW50	IS47GW50MMYY			TBD	X
Site 47	GW	IS47GW51	IS47GW51MMYY			TBD	X
<b>Field QC Samples<sup>1</sup></b>							
Site 47	GW	IS47GW43	IS47GW43PMMYY			TBD	X
Site 47	GW	IS47GW44	IS47GW44MMYY-MS			TBD	X
Site 47	GW	IS47GW44	IS47GW44MMYY-SD			TBD	X
Site 47	AQ	IS47QC (Equipment Blank)	IS47E801MMDDYY				X
Site 47	AQ	IS47QC (Trip Blank)	IS47T801MMDDYY				X
<b>Total Number of Samples to the Laboratory:</b>							<b>16</b>

<sup>1</sup>Frequency of Field QA/QC Sample Collection (assuming GW sampling occupies two days; decontaminated equipment; samples shipped daily)

Field Duplicate: One per 10 normal field samples

MS/MSD Pair: One pair per 20 normal field samples

Trip Blank: One per cooler containing VOCs samples

Equipment Blank: One per day per equipment type

### 3.3.2 Field Project Instructions (AQ, SB)

#### Sample Details

<p><b>Navy CLEAN 8012 CTO-JU05</b>  <b>NSF Indian Head Site 47</b>  <b>Pre-Design Investigation</b></p> <p><b>ENCO Laboratories</b>  <b>Attn: Sample Receiving</b>  <b>10775 Central Port Drive</b>  <b>Orlando, FL 32824</b></p> <p><b>POC: Ronnie Wambles</b>  <b>(407) 826-5314</b></p>						Analyze Group	VOC	TOC
						Preparation and Analytical Method	SW-846 8260B	Walkley Black
						Analytical Laboratory	ENCO Laboratories - Orlando	
						Analytical SOP Reference	VGCMS-05	WETS-90
						Data Package Turnaround Time	21 Calendar-day	
						Container Type	4 x 40mL vials	1 x 4oz Glass Jar
						Volume Required	5g	1g
						Preservative	3 vials of DI w/ stir bar and 1 vial of MeOH, (4±2) °C	(4±2) °C
						Holding Time (Preparation/analyze)	48 hours to freeze (-10°C)/14 days to analyze	14 days
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval		
				X	Y			
Site 47	SB	IS47SB23	IS47SB23TDBD			TBD	X	X
Site 47	SB	IS47SB23	IS47SB23TDBD			TBD	X	X
Site 47	SB	IS47SB23	IS47SB23TDBD			TBD	X	X
Site 47	SB	IS47SB24	IS47SB24TDBD			TBD	X	X
Site 47	SB	IS47SB24	IS47SB24TDBD			TBD	X	X
Site 47	SB	IS47SB24	IS47SB24TDBD			TBD	X	X
Site 47	SB	IS47SB25	IS47SB25TDBD			TBD	X	X
Site 47	SB	IS47SB25	IS47SB25TDBD			TBD	X	X
Site 47	SB	IS47SB25	IS47SB25TDBD			TBD	X	X
Site 47	SB	IS47SB26	IS47SB26TDBD			TBD	X	X
Site 47	SB	IS47SB26	IS47SB26TDBD			TBD	X	X
Site 47	SB	IS47SB26	IS47SB26TDBD			TBD	X	X
Site 47	SB	IS47SB27	IS47SB27TDBD			TBD	X	X
Site 47	SB	IS47SB27	IS47SB27TDBD			TBD	X	X
Site 47	SB	IS47SB27	IS47SB27TDBD			TBD	X	X
Site 47	SB	IS47SB28	IS47SB28TDBD			TBD	X	X
Site 47	SB	IS47SB28	IS47SB28TDBD			TBD	X	X
Site 47	SB	IS47SB28	IS47SB28TDBD			TBD	X	X
Site 47	SB	IS47SB29	IS47SB29TDBD			TBD	X	X
Site 47	SB	IS47SB29	IS47SB29TDBD			TBD	X	X
Site 47	SB	IS47SB29	IS47SB29TDBD			TBD	X	X
Site 47	SB	IS47SB30	IS47SB30TDBD			TBD	X	X
Site 47	SB	IS47SB30	IS47SB30TDBD			TBD	X	X

### 3.3.2 Field Project Instructions (AQ, SB)

#### Sample Details

<p style="text-align: center;">Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 Pre-Design Investigation</p> <p style="text-align: center;">ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824</p> <p style="text-align: center;">POC: Ronnie Wambles (407) 826-5314</p>						Analyze Group	VOC	TOC
						Preparation and Analytical Method	SW-846 8260B	Walkley Black
						Analytical Laboratory	ENCO Laboratories - Orlando	
						Analytical SOP Reference	VGCMS-05	WETS-90
						Data Package Turnaround Time	21 Calendar-day	
						Container Type	4 x 40mL vials	1 x 4oz Glass Jar
						Volume Required	5g	1g
						Preservative	3 vials of DI w/ stir bar and 1 vial of MeOH, (4±2) °C	(4±2) °C
						Holding Time (Preparation/analyze)	48 hours to freeze (-10°C)/14 days to analyze	14 days
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval		
				X	Y			
Site 47	SB	IS47SB30	IS47SB30TDBD			TBD	X	X
Site 47	SB	IS47SB31	IS47SB31TDBD			TBD	X	X
Site 47	SB	IS47SB31	IS47SB31TDBD			TBD	X	X
Site 47	SB	IS47SB31	IS47SB31TDBD			TBD	X	X
<b>Field QC Samples</b>								
Site 47	SB	IS47SB23	IS47SB23PTDBD			TBD	X	
Site 47	SB	IS47SB23	IS47SB23TDBD-MS			TBD	X	
Site 47	SB	IS47SB23	IS47SB23TDBD-SD			TBD	X	
Site 47	SB	IS47SB26	IS47SB26PTDBD			TBD	X	
Site 47	SB	IS47SB26	IS47SB26TDBD-MS			TBD	X	
Site 47	SB	IS47SB26	IS47SB26TDBD-SD			TBD	X	
Site 47	SB	IS47SB30	IS47SB30PTDBD			TBD	X	
Site 47	AQ	IS47QC (Equipment Blank)	IS47EB01MMDDYY				X	
Site 47	AQ	IS47QC (Trip Blank)	IS47TB01MMDDYY				X	
<b>Total Number of Samples to the Laboratory:</b>							<b>38</b>	<b>27</b>

<sup>1</sup>Frequency of Field QA/QC Sample Collection (assuming SB sampling occupies 2 days; decontaminated equipment; samples shipped daily)

Field Duplicate: One per 10 normal field samples

MS/MSD Pair: One pair per 20 normal field samples

Trip Blank: One per cooler containing VOCs samples

Equipment Blank: One per day per equipment type

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3.3.3 Field Project Instructions (AQ, GW)

Sample Details																		
<div>Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 Baseline</div> <div>ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824 POC: Ronnie Wambles (407) 826-5314</div> <div>Microbial Insights, Inc. Attn: Sample Receiving 2340 Stock Creek Blvd Rockford, TN 37853 POC: Anita Biernacki (865) 573-8188 X108</div>						Analyze Group		VOC	METAL	FILTERED METAL	TOC	Sulfide	Sulfate	Nitrate	Alkalinity	MEE	MICRO <sup>2</sup>	
						Preparation and Analytical Method		SW-846 8260B	SW-846 6020A	SW-846 6020A	SW-846 9060	SM4500-S2-F	EPA 300.0		SM2320B	RSK-175	qPCR	
						Analytical Laboratory		ENCO Laboratories - Orlando									ENCO Laboratories - Jacksonville	Microbial Insights, Inc.
						Analytical SOP Reference		VGCMS-05	EXMT-07, MET-15	EXMT-07, MET-15	WETS-66	WETS-061	WETS-057		WETS-047	VCG-11	DNA-EXT, DNA-qPCR	
						Data Package Turnaround Time		21 Calendar-day										
						Container Type		3 x 40mL vials	1 x 250mL HDPE	1 x 250mL HDPE	2 x 40mL vials	1 x 250mL HDPE	1 x 500mL HDPE			3 x 40mL vials	1 x 1L HDPE or 1 x Bio-flo filter	
						Volume Required		40mL	50 mL	50 mL	5 mL	250 mL	50 mL		50 mL	40mL	1L <sup>3</sup>	
						Preservative		zero-headspace, HCl to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	H <sub>3</sub> PO <sub>4</sub> to pH < 2, (4±2) °C	Zn Acetate + NaOH to pH > 12, (4±2) °C	(4±2) °C			zero-headspace, HCl to pH < 2, (4±2) °C	(4±2) °C	
Holding Time (Preparation/analyze)		14 days to analyze	180 days to analyze	180 days to analyze	28 days to analyze	7 days to analyze	28 days to analyze	48 hours to analyze	14 days to analyze	14 days to analyze	24-48 hours to analyze							
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval												
				X	Y													
Site 47	GW	IS47MW01	IS47MW01MMYY			14 – 24	X	X	X	X			X	X	X	X		
Site 47	GW	IS47MW02	IS47MW02MMYY			7 – 17	X	X	X									
Site 47	GW	IS47MW03	IS47MW03MMYY			8 – 18	X	X	X	X	X	X	X	X	X	X		
Site 47	GW	IS47MW04	IS47MW04MMYY			6 – 16	X	X	X		X	X						
Site 47	GW	IS47MW05	IS47MW05MMYY			3 – 13	X	X	X	X			X	X	X	X		
Site 47	GW	IS47MW06	IS47MW06MMYY			5 – 15	X	X	X									
Site 47	GW	IS47MW09	IS47MW09MMYY			16 – 26	X	X	X									
Site 47	GW	IS47MW10	IS47MW10MMYY			7 – 17	X	X	X									
Site 47	GW	IS47MW19	IS47MW19MMYY			7 – 17	X	X	X	X	X	X	X	X	X	X		
Site 47	GW	IS47MW20	IS47MW20MMYY			7.5 – 17.5	X	X	X		X	X						
Site 47	GW	IS47MW21	IS47MW21MMYY			8 – 18	X	X	X		X	X						
Site 47	GW	IS47MW22	IS47MW22MMYY			5.5 – 15	X	X	X	X	X	X	X	X	X	X		
Site 47	GW	IS47MW23	IS47MW23MMYY			4.5 – 14.5	X	X	X	X	X	X	X	X	X	X		
Site 47	GW	IS47MW24	IS47MW24MMYY			6 – 16	X	X	X	X	X	X	X	X	X	X		
Site 47	GW	IS47MW25	IS47MW25MMYY			TBD	X	X	X		X	X						
Site 47	GW	IS47MW26	IS47MW26MMYY			TBD	X	X	X	X	X	X	X	X	X	X		
Site 47	GW	IS47MW27	IS47MW27MMYY			TBD	X	X	X		X	X						
Site 47	GW	IS47MW28	IS47MW28MMYY			TBD	X	X	X	X	X	X	X	X	X	X		
Site 47	GW	IS47MW29	IS47MW29MMYY			TBD	X	X	X		X	X						
Site 47	GW	IS47MW30	IS47MW30MMYY			TBD	X	X	X	X	X	X	X	X	X	X		
Site 47	GW	IS47MW31	IS47MW31MMYY			TBD	X	X	X		X	X						
Site 47	GW	IS47MW32	IS47MW32MMYY			TBD	X	X	X	X	X	X	X	X	X	X		
Field QC Samples																		
Site 47	GW	IS47MW03	IS47MW03PMMYY			8 – 18	X	X	X									
Site 47	GW	IS47MW01	IS47MW01MMYY-MS			14 – 24	X	X	X									
Site 47	GW	IS47MW01	IS47MW01MMYY-SD			14 – 24	X	X	X									
Site 47	GW	IS47MW19	IS47MW19PMMYY			7 – 17	X	X	X									
Site 47	GW	IS47MW05	IS47MW05MMYY-MS			3 – 13	X	X	X									
Site 47	GW	IS47MW05	IS47MW05MMYY-SD			3 – 13	X	X	X									
Site 47	GW	IS47MW24	IS47MW24PMMYY			6 – 16	X	X	X									

3.3.3 Field Project Instructions (AQ, GW)

Sample Details																
<p>Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 Baseline</p> <p>ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824 POC: Ronnie Wambles (407) 826-5314</p> <p>Microbial Insights, Inc. Attn: Sample Receiving 2340 Stock Creek Blvd Rockford, TN 37853 POC: Anita Biernacki (865) 573-8188 X108</p>					Analyze Group	VOC	METAL	FILTERED METAL	TOC	Sulfide	Sulfate	Nitrate	Alkalinity	MEE	MICRO <sup>2</sup>	
					Preparation and Analytical Method	SW-846 8260B	SW-846 6020A	SW-846 6020A	SW-846 9060	SM4500-S2-F	EPA 300.0		SM2320B	RSK-175	qPCR	
					Analytical Laboratory	ENCO Laboratories - Orlando									ENCO Laboratories - Jacksonville	Microbial Insights, Inc.
					Analytical SOP Reference	VGCMS-05	EXMT-07, MET-15	EXMT-07, MET-15	WETS-66	WETS-061	WETS-057		WETS-047	VCG-11	DNA-EXT, DNA-qPCR	
					Data Package Turnaround Time	21 Calendar-day										
					Container Type	3 x 40mL vials	1 x 250mL HDPE	1 x 250mL HDPE	2 x 40mL vials	1 x 250mL HDPE	1 x 500mL HDPE			3 x 40mL vials	1 x 1L HDPE or 1 x Bio-flo filter	
					Volume Required	40mL	50 mL	50 mL	5 mL	250 mL	50 mL		50 mL	40mL	1L <sup>3</sup>	
					Preservative	zero-headspace, HCl to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	H <sub>3</sub> PO <sub>4</sub> to pH < 2, (4±2) °C	Zn Acetate + NaOH to pH > 12, (4±2) °C	(4±2) °C			zero-headspace, HCl to pH < 2, (4±2) °C	(4±2) °C	
					Holding Time (Preparation/analyze)	14 days to analyze	180 days to analyze	180 days to analyze	28 days to analyze	7 days to analyze	28 days to analyze	48 hours to analyze	14 days to analyze	14 days to analyze	24-48 hours to analyze	
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval										
				X	Y											
Site 47	AQ	IS47QC (Equipment Blank)	IS47EB01MMDDYY				X	X	X							
Site 47	AQ	IS47QC (Trip Blank)	IS47TB01MMDDYY				X									
Total Number of Samples to the Laboratory:							39	34	34	11	16	16	11	11	11	

<sup>1</sup>Frequency of Field QA/QC Sample Collection (assuming GW sampling occupies 5 days; decontaminated equipment; samples shipped daily)

Field Duplicate: One per 10 normal field samples

MS/MSD Pair: One pair per 20 normal field samples

Trip Blank: One per cooler containing VOCs samples

Equipment Blank: One per day per equipment type

<sup>2</sup>Ship MICRO samples to Microbial Insights, Inc. and all other fractions to ENCO Laboratories - Orlando.

<sup>3</sup>To provide HDPE containers, collect the entire sample volume. To provide Bio-flo filters (these are preferred), record the volume which has passed through the filter, discard the water, and submit the filter for analysis. Collect water until the filter clogs. If less than 100mL passes through the filter, collect a second Bio-flo filter. There is no need to collect more than 1000mL of water.

3.3.4 Field Project Instructions (AQ, SB)

Sample Details						Analyze Group	VOC	TOC	METAL
<div>Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 Baseline  ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824  POC: Ronnie Wambles (407) 826-5314</div>						Preparation and Analytical Method	SW-846 8260B	Walkley Black	SW-846 6020A
						Analytical Laboratory	ENCO Laboratories - Orlando		
						Analytical SOP Reference	VGCMS-05	WETS-90	EXMT-09, MET-15
						Data Package Turnaround Time	21 Calendar-day		
						Container Type	4 x 40mL vials	1 x 4oz Glass Jar	
						Volume Required	5g	1g	10g
						Preservative	3 vials of DI w/ stir bar and 1 vial of MeOH, (4±2) °C	(4±2) °C	
						Holding Time (Preparation/analyze)	48 hours to freeze (-10°C)/14 days to analyze	14 days to analyze	180 days to analyze
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval			
				X	Y				
Site 47	SB	IS47SB32	IS47SB32TDBD			TBD	X	X	X
Site 47	SB	IS47SB32	IS47SB32TDBD			TBD	X	X	X
Site 47	SB	IS47SB33	IS47SB33TDBD			TBD	X	X	X
Site 47	SB	IS47SB33	IS47SB33TDBD			TBD	X	X	X
Site 47	SB	IS47SB34	IS47SB34TDBD			TBD	X	X	X
Site 47	SB	IS47SB34	IS47SB34TDBD			TBD	X	X	X
Site 47	SB	IS47SB35	IS47SB35TDBD			TBD	X	X	X
Site 47	SB	IS47SB35	IS47SB35TDBD			TBD	X	X	X
Site 47	SB	IS47SB36	IS47SB36TDBD			TBD	X	X	X
Site 47	SB	IS47SB36	IS47SB36TDBD			TBD	X	X	X
Site 47	SB	IS47SB37	IS47SB37TDBD			TBD	X	X	X
Site 47	SB	IS47SB37	IS47SB37TDBD			TBD	X	X	X
Site 47	SB	IS47SB38	IS47SB38TDBD			TBD	X	X	X
Site 47	SB	IS47SB38	IS47SB38TDBD			TBD	X	X	X
Site 47	SB	IS47SB39	IS47SB39TDBD			TBD	X	X	X
Site 47	SB	IS47SB39	IS47SB39TDBD			TBD	X	X	X
Field QC Samples <sup>1</sup>									
Site 47	SB	IS47SB32	IS47SB32PTDBD			TBD	X		X
Site 47	SB	IS47SB33	IS47SB33TDBD-MS			TBD	X		X
Site 47	SB	IS47SB33	IS47SB33TDBD-SD			TBD	X		X
Site 47	SB	IS47SB37	IS47SB37PTDBD			TBD	X		X
Site 47	AQ	IS47QC (Equipment Blank)	IS47EB01MMDDYY				X		X
Site 47	AQ	IS47QC (Trip Blank)	IS47TB01MMDDYY				X		
Total Number of Samples to the Laboratory:							24	16	22

<sup>1</sup>Frequency of Field QA/QC Sample Collection (assuming SB sampling occupies 2 days; decontaminated equipment; samples shipped daily)  
Field Duplicate: One per 10 normal field samples  
MS/MSD Pair: One pair per 20 normal field samples  
Trip Blank: One per cooler containing VOCs samples  
Equipment Blank: One per day per equipment type

3.3.5 Field Project Instructions (AQ, GW)

<div>Sample Details</div> <div>Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 2-Month post injection and 6-Month post injection  ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824  POC: Ronnie Wambles (407) 826-5314</div>						Analyze Group	VOC <sup>2</sup>	METAL	FILTERED METAL		Sulfate
						Preparation and Analytical Method	SW-846 8260B	SW-846 6020A	SW-846 6020A		EPA 300.0
						Analytical Laboratory	ENCO Laboratories - Orlando				
						Analytical SOP Reference	VGCMS-05	EXMT-07, MET-15	EXMT-07, MET-15		WETS-057
						Data Package Turnaround Time	21 Calendar-day				
						Container Type	3 x 40mL vials	1 x 250mL HDPE	1 x 250mL HDPE		1 x 500mL HDPE
						Volume Required	40mL	50 mL	50 mL		50 mL
						Preservative	zero-headspace, HCl to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C		(4±2) °C
						Holding Time (Preparation/analyze)	14 days to analyze	180 days to analyze	180 days to analyze		28 days to analyze
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval					
				X	Y						
Site 47	GW	IS47MW01	IS47MW01MMYY			14 – 24	X	X	X		
Site 47	GW	IS47MW02	IS47MW02MMYY			7 – 17	X	X	X		
Site 47	GW	IS47MW03	IS47MW03MMYY			8 – 18	X	X	X		X
Site 47	GW	IS47MW04	IS47MW04MMYY			6 – 16	X	X	X		X
Site 47	GW	IS47MW05	IS47MW05MMYY			3 – 13	X	X	X		
Site 47	GW	IS47MW06	IS47MW06MMYY			5 – 15	X	X	X		
Site 47	GW	IS47MW09	IS47MW09MMYY			16 – 26	X	X	X		
Site 47	GW	IS47MW10	IS47MW10MMYY			7 – 17	X	X	X		
Site 47	GW	IS47MW19	IS47MW19MMYY			7 – 17	X	X	X		X
Site 47	GW	IS47MW20	IS47MW20MMYY			7.5 – 17.5	X	X	X		X
Site 47	GW	IS47MW21	IS47MW21MMYY			8 – 18	X	X	X		X
Site 47	GW	IS47MW22	IS47MW22MMYY			5.5 – 15	X	X	X		X
Site 47	GW	IS47MW23	IS47MW23MMYY			4.5 – 14.5	X	X	X		X
Site 47	GW	IS47MW24	IS47MW24MMYY			6 – 16	X	X	X		X
Site 47	GW	IS47MW25	IS47MW25MMYY			TBD	X	X	X		X
Site 47	GW	IS47MW26	IS47MW26MMYY			TBD	X	X	X		X
Site 47	GW	IS47MW27	IS47MW27MMYY			TBD	X	X	X		X
Site 47	GW	IS47MW28	IS47MW28MMYY			TBD	X	X	X		X
Site 47	GW	IS47MW29	IS47MW29MMYY			TBD	X	X	X		X
Site 47	GW	IS47MW30	IS47MW30MMYY			TBD	X	X	X		X
Site 47	GW	IS47MW31	IS47MW31MMYY			TBD	X	X	X		X
Site 47	GW	IS47MW32	IS47MW32MMYY			TBD	X	X	X		X
Field D Samples											
Site 47	GW	IS47MW03	IS47MW03PMMYY			8 – 18	X	X	X		
Site 47	GW	IS47MW01	IS47MW01MMYY-MS			14 – 24	X	X	X		
Site 47	GW	IS47MW01	IS47MW01MMYY-SD			14 – 24	X	X	X		
Site 47	GW	IS47MW19	IS47MW19PMMYY			7 – 17	X	X	X		

3.3.5 Field Project Instructions (AQ, GW)

<div>Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 2-Month post injection and 6-Month post injection  ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824  POC: Ronnie Wambles (407) 826-5314</div>						Sample Details					
						Analyze Group	VOC <sup>2</sup>	METAL	FILTERED METAL		Sulfate
						Preparation and Analytical Method	SW-846 8260B	SW-846 6020A	SW-846 6020A		EPA 300.0
						Analytical Laboratory	ENCO Laboratories - Orlando				
						Analytical SOP Reference	VGCMS-05	EXMT-07, MET-15	EXMT-07, MET-15		WETS-057
						Data Package Turnaround Time	21 Calendar-day				
						Container Type	3 x 40mL vials	1 x 250mL HDPE	1 x 250mL HDPE		1 x 500mL HDPE
						Volume Required	40mL	50 mL	50 mL		50 mL
						Preservative	zero-headspace, HCl to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C		(4±2) °C
						Holding Time (Preparation/analyze)	14 days to analyze	180 days to analyze	180 days to analyze		28 days to analyze
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval					
				X	Y						
Site 47	GW	IS47MW05	IS47MW05MMYY-MS			3 – 13	X	X	X		
Site 47	GW	IS47MW05	IS47MW05MMYY-SD			3 – 13	X	X	X		
Site 47	GW	IS47MW24	IS47MW24PMMYY			6 – 16	X	X	X		
Site 47	AQ	IS47QC (Equipment Blank)	IS47EB01MMDDYY				X	X	X		
Site 47	AQ	IS47QC (Trip Blank)	IS47TB01MMDDYY				X				
Total Number of Samples to the Laboratory:							39	34	34		16

<sup>1</sup>Frequency of Field QA/QC Sample Collection (assuming GW sampling occupies 5 days; decontaminated equipment; samples shipped daily)

- Field Duplicate: One per 10 normal field samples
- MS/MSD Pair: One pair per 20 normal field samples
- Trip Blank: One per cooler containing VOCs samples
- Equipment Blank: One per day per equipment type

<sup>2</sup>If persulfate concentration exceeds 500mg/L in groundwater prior to sampling at any station, then all aqueous VOCs samples will be preserved with between 4:1 and 40:1 molar ratio ascorbic acid to persulfate. The holding time is then 7 days. A SOP for the technique has not been created, but the UFP-SAP will be amended with the SOP before the baseline sampling event.

3.3.6 Field Project Instructions (AQ, GW)

<div>Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 9-Month post injection</div> <div>ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824 POC: Ronnie Wambles (407) 826-5314</div> <div>Microbial Insights, Inc. Attn: Sample Receiving 2340 Stock Creek Blvd Rockford, TN 37853 POC: Anita Biernacki (865) 573-8188 X108</div>						Analyze Group	VOC <sup>4</sup>	METAL	FILTERED METAL	TOC	Sulfide	Sulfate	Nitrate	Alkalinity	MEE	MICRO <sup>2</sup>	
						Preparation and Analytical Method	SW-846 8260B	SW-846 6020A	SW-846 6020A	SW-846 9060	SM4500-S2-F	EPA 300.0		SM2320B	RSK-175	qPCR	
						Analytical Laboratory	ENCO Laboratories - Orlando									ENCO Laboratories - Jacksonville	Microbial Insights, Inc.
						Analytical SOP Reference	VGCMS-05	EXMT-07, MET-15	EXMT-07, MET-15	WETS-66	WETS-061	WETS-057		WETS-047	VCG-11	DNA-EXT, DNA-qPCR	
						Data Package Turnaround Time	21 Calendar-day										
						Container Type	3 x 40mL vials	1 x 250mL HDPE	1 x 250mL HDPE	2 x 40mL vials	1 x 250mL HDPE	1 x 500mL HDPE			3 x 40mL vials	1 x 1L HDPE or 1 x Bio-flo filter	
						Volume Required	40mL	50 mL	50 mL	5 mL	250 mL	50 mL		50 mL	40mL	1L <sup>3</sup>	
						Preservative	zero-headspace, HCl to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	H <sub>3</sub> PO <sub>4</sub> to pH < 2, (4±2) °C	Zn Acetate + NaOH to pH > 12, (4±2) °C	(4±2) °C			zero-headspace, HCl to pH < 2, (4±2) °C	(4±2) °C	
						Holding Time (Preparation/analyze)	14 days to analyze	180 days to analyze	180 days to analyze	28 days to analyze	7 days to analyze	28 days to analyze	48 hours to analyze	14 days to analyze	14 days to analyze	24-48 hours to analyze	
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval											
				X	Y												
Site 47	GW	IS47MW01	IS47MW01MMYY			14 – 24	X	X	X	X			X	X	X	X	
Site 47	GW	IS47MW02	IS47MW02MMYY			7 – 17	X	X	X								
Site 47	GW	IS47MW03	IS47MW03MMYY			8 – 18	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW04	IS47MW04MMYY			6 – 16	X	X	X	X	X						
Site 47	GW	IS47MW05	IS47MW05MMYY			3 – 13	X	X	X	X			X	X	X	X	
Site 47	GW	IS47MW06	IS47MW06MMYY			5 – 15	X	X	X								
Site 47	GW	IS47MW09	IS47MW09MMYY			16 – 26	X	X	X								
Site 47	GW	IS47MW10	IS47MW10MMYY			7 – 17	X	X	X								
Site 47	GW	IS47MW19	IS47MW19MMYY			7 – 17	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW20	IS47MW20MMYY			7.5 – 17.5	X	X	X	X	X						
Site 47	GW	IS47MW21	IS47MW21MMYY			8 – 18	X	X	X	X	X						
Site 47	GW	IS47MW22	IS47MW22MMYY			5.5 – 15	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW23	IS47MW23MMYY			4.5 – 14.5	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW24	IS47MW24MMYY			6 – 16	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW25	IS47MW25MMYY			TBD	X	X	X	X	X						
Site 47	GW	IS47MW26	IS47MW26MMYY			TBD	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW27	IS47MW27MMYY			TBD	X	X	X	X	X						
Site 47	GW	IS47MW28	IS47MW28MMYY			TBD	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW29	IS47MW29MMYY			TBD	X	X	X	X	X						
Site 47	GW	IS47MW30	IS47MW30MMYY			TBD	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW31	IS47MW31MMYY			TBD	X	X	X	X	X						
Site 47	GW	IS47MW32	IS47MW32MMYY			TBD	X	X	X	X	X	X	X	X	X	X	
Site 47	GW	IS47MW03	IS47MW03PMMYY			8 – 18	X	X	X								
Site 47	GW	IS47MW01	IS47MW01MMYY-MS			14 – 24	X	X	X								

3.3.6 Field Project Instructions (AQ, GW)

<div>Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 9-Month post injection</div> <div>ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824 POC: Ronnie Wambles (407) 826-5314</div> <div>Microbial Insights, Inc. Attn: Sample Receiving 2340 Stock Creek Blvd Rockford, TN 37853 POC: Anita Biernacki (865) 573-8188 X108</div>				Sample Details												
				Analyze Group	VOC <sup>4</sup>	METAL	FILTERED METAL	TOC	Sulfide	Sulfate	Nitrate	Alkalinity	MEE	MICRO <sup>2</sup>		
				Preparation and Analytical Method	SW-846 8260B	SW-846 6020A	SW-846 6020A	SW-846 9060	SM4500-S2-F	EPA 300.0		SM2320B	RSK-175	qPCR		
				Analytical Laboratory	ENCO Laboratories - Orlando								ENCO Laboratories - Jacksonville	Microbial Insights, Inc.		
				Analytical SOP Reference	VGCMS-05	EXMT-07, MET-15	EXMT-07, MET-15	WETS-66	WETS-061	WETS-057		WETS-047	VCG-11	DNA-EXT, DNA-qPCR		
				Data Package Turnaround Time	21 Calendar-day											
				Container Type	3 x 40mL vials	1 x 250mL HDPE	1 x 250mL HDPE	2 x 40mL vials	1 x 250mL HDPE	1 x 500mL HDPE			3 x 40mL vials	1 x 1L HDPE or 1 x Bio-flo filter		
				Volume Required	40mL	50 mL	50 mL	5 mL	250 mL	50 mL		50 mL	40mL	1L <sup>3</sup>		
				Preservative	zero-headspace, HCl to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	HNO <sub>3</sub> to pH < 2, (4±2) °C	H <sub>3</sub> PO <sub>4</sub> to pH < 2, (4±2) °C	Zn Acetate + NaOH to pH > 12, (4±2) °C	(4±2) °C			zero-headspace, HCl to pH < 2, (4±2) °C	(4±2) °C		
Holding Time (Preparation/analyze)	14 days to analyze	180 days to analyze	180 days to analyze	28 days to analyze	7 days to analyze	28 days to analyze	48 hours to analyze	14 days to analyze	14 days to analyze	24-48 hours to analyze						
Site	Matrix	Station ID	Sample ID	Coordinates		Depth / Sampling Interval										
				X	Y											
Site 47	GW	IS47MW01	IS47MW01MMYY-SD			14 – 24	X	X	X							
Site 47	GW	IS47MW19	IS47MW19PMMYY			7 – 17	X	X	X							
Site 47	GW	IS47MW05	IS47MW05MMYY-MS			3 – 13	X	X	X							
Site 47	GW	IS47MW05	IS47MW05MMYY-SD			3 – 13	X	X	X							
Site 47	GW	IS47MW24	IS47MW24PMMYY			6 – 16	X	X	X							
Site 47	AQ	IS47QC (Equipment Blank)	IS47EB01MMDDYY				X	X	X							
Site 47	AQ	IS47QC (Trip Blank)	IS47TB01MMDDYY				X									
Total Number of Samples to the Laboratory:							39	34	34	11	16	16	11	11	11	11

<sup>1</sup>Frequency of Field QA/QC Sample Collection (assuming GW sampling occupies 5 days; decontaminated equipment; samples shipped daily)

- Field Duplicate: One per 10 normal field samples
- MS/MSD Pair: One pair per 20 normal field samples
- Trip Blank: One per cooler containing VOCs samples
- Equipment Blank: One per day per equipment type

<sup>2</sup>Ship MICRO samples to Microbial Insights, Inc. and all other fractions to ENCO Laboratories - Orlando.

<sup>3</sup>To provide HDPE containers, collect the entire sample volume. To provide Bio-flo filters (these are preferred), record the volume which has passed through the filter, discard the water, and submit the filter for analysis. Collect water until the filter clogs. If less than 100mL passes through the filter, collect a second Bio-flo filter. There is no need to collect more than 1000mL of water.

<sup>4</sup> If persulfate concentration exceeds 500mg/L in groundwater prior to sampling at any station, then all aqueous VOCs samples will be preserved with between 4:1 and 40:1 molar ratio ascorbic acid to persulfate. The holding time is then 7 days. A SOP for the technique has not been created, but the UFP-SAP will be amended with the SOP before the baseline sampling event.

3.3.7 Field Project Instructions (AQ, SB)

Sample Details

<div>Navy CLEAN 8012 CTO-JU05 NSF Indian Head Site 47 9-Month post injection</div> <div>ENCO Laboratories Attn: Sample Receiving 10775 Central Port Drive Orlando, FL 32824</div> <div>POC: Ronnie Wambles (407) 826-5314</div>						Analyze Group	VOC	TOC	METAL
						Preparation and Analytical Method	SW-846 8260B	Walkley Black	SW-846 6020A
						Analytical Laboratory	ENCO Laboratories - Orlando		
						Analytical SOP Reference	VGCMS-05	WETS-90	EXMT-09, MET-15
						Data Package Turnaround Time	21 Calendar-day		
						Container Type	4 x 40mL vials	1 x 4oz Glass Jar	1 x 4oz Glass Jar
						Volume Required	5g	1g	10g
						Preservative	3 vials of DI w/ stir bar and 1 vial of MeOH, (4±2) °C	(4±2) °C	
						Holding Time (Preparation/analyze)	48 hours to freeze (-10°C)/14 days to analyze	14 days	180 days to analyze
Site	Matrix	Station ID	Sample ID		Y	Depth / Sampling Interval			
Site 47	SB	IS47SB40	IS47SB40TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB40	IS47SB40TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB41	IS47SB41TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB41	IS47SB41TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB42	IS47SB42TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB42	IS47SB42TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB43	IS47SB43TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB43	IS47SB43TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB44	IS47SB44TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB44	IS47SB44TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB45	IS47SB45TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB45	IS47SB45TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB46	IS47SB46TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB46	IS47SB46TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB47	IS47SB47TDBD	X		TBD	X	X	X
Site 47	SB	IS47SB47	IS47SB47TDBD	X		TBD	X	X	X
Field QC Samples									
Site 47	SB	IS47SB40	IS47SB40PTDBD	X		TBD	X		X
Site 47	SB	IS47SB41	IS47SB41TDBD-MS	X		TBD	X		X
Site 47	SB	IS47SB41	IS47SB41TDBD-SD	X		TBD	X		X
Site 47	SB	IS47SB45	IS47SB45PTDBD	X		TBD	X		X
Site 47	AQ	IS47QC (Equipment Blank)	IS47EB01MMDDYY	X			X		X
Site 47	AQ	IS47QC (Trip Blank)	IS47TB01MMDDYY				X		
Total Number of Samples to the Laboratory:							13	8	22

<sup>1</sup>Frequency of Field QA/QC Sample Collection (assuming SB sampling occupies 2 days; decontaminated equipment; samples shipped daily)

Field Duplicate: One per 10 normal field samples

MS/MSD Pair: One pair per 20 normal field samples

Trip Blank: One per cooler containing VOCs samples

Equipment Blank: One per day per equipment type

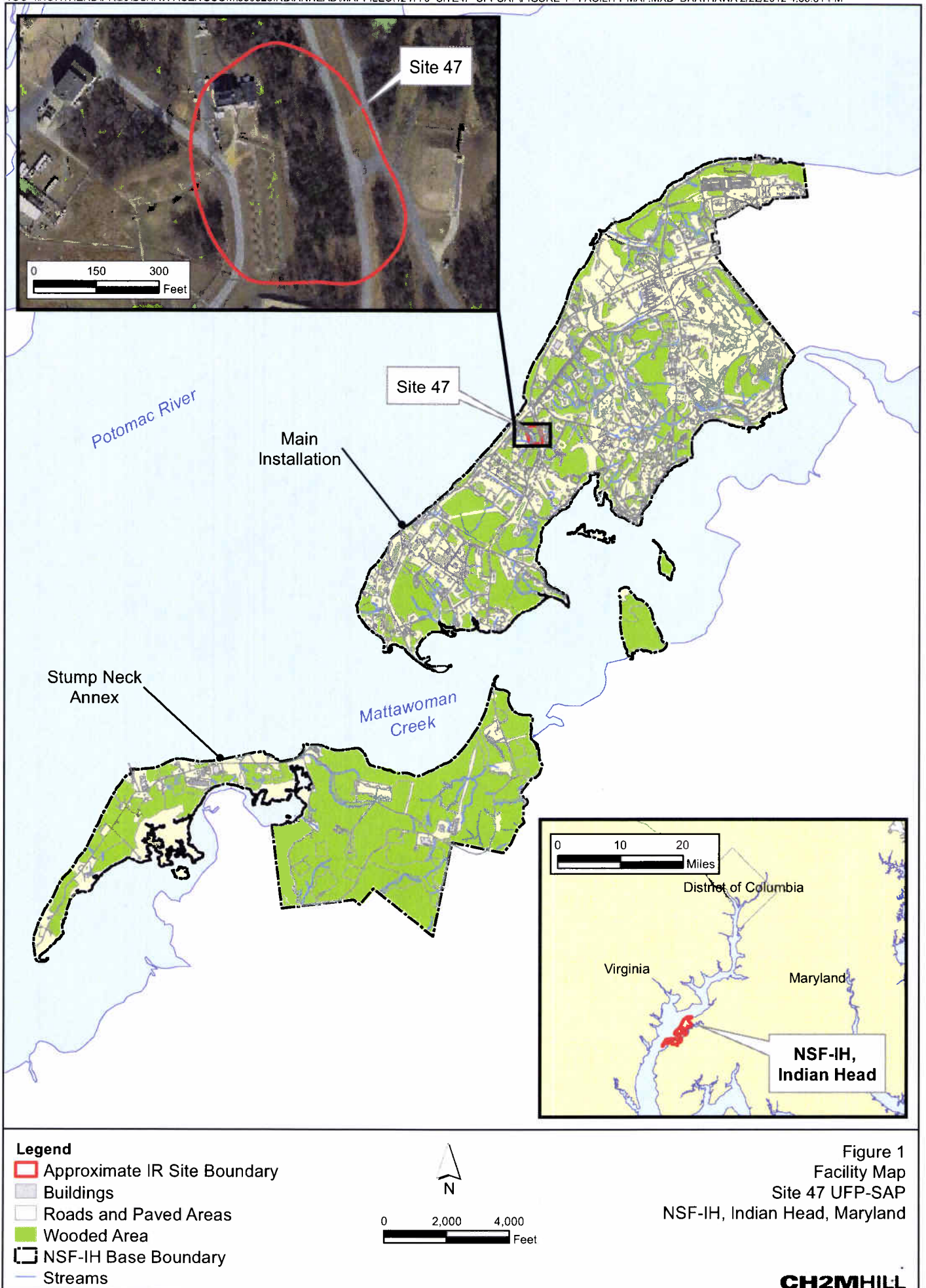
## 4 References

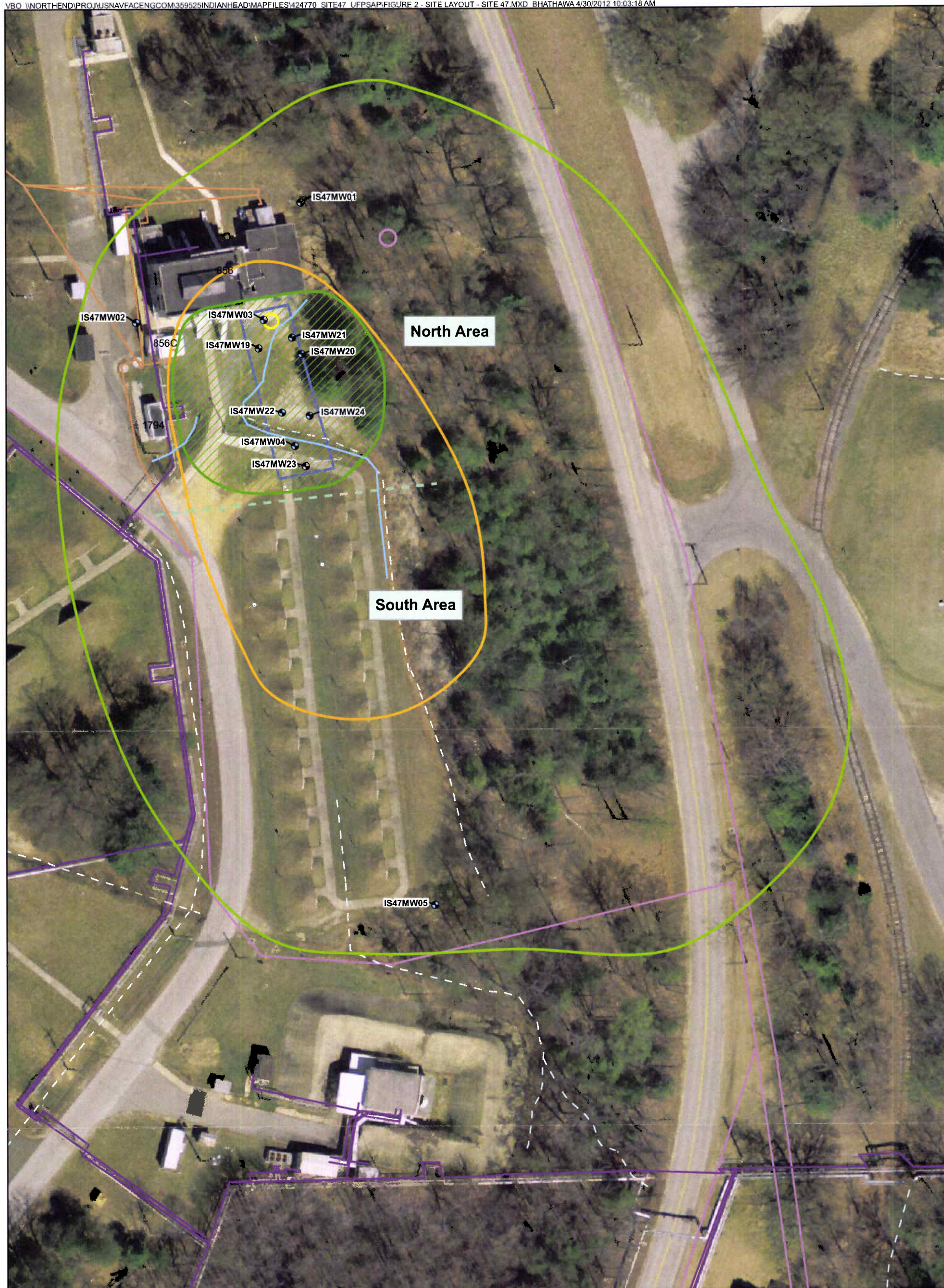
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## Figures

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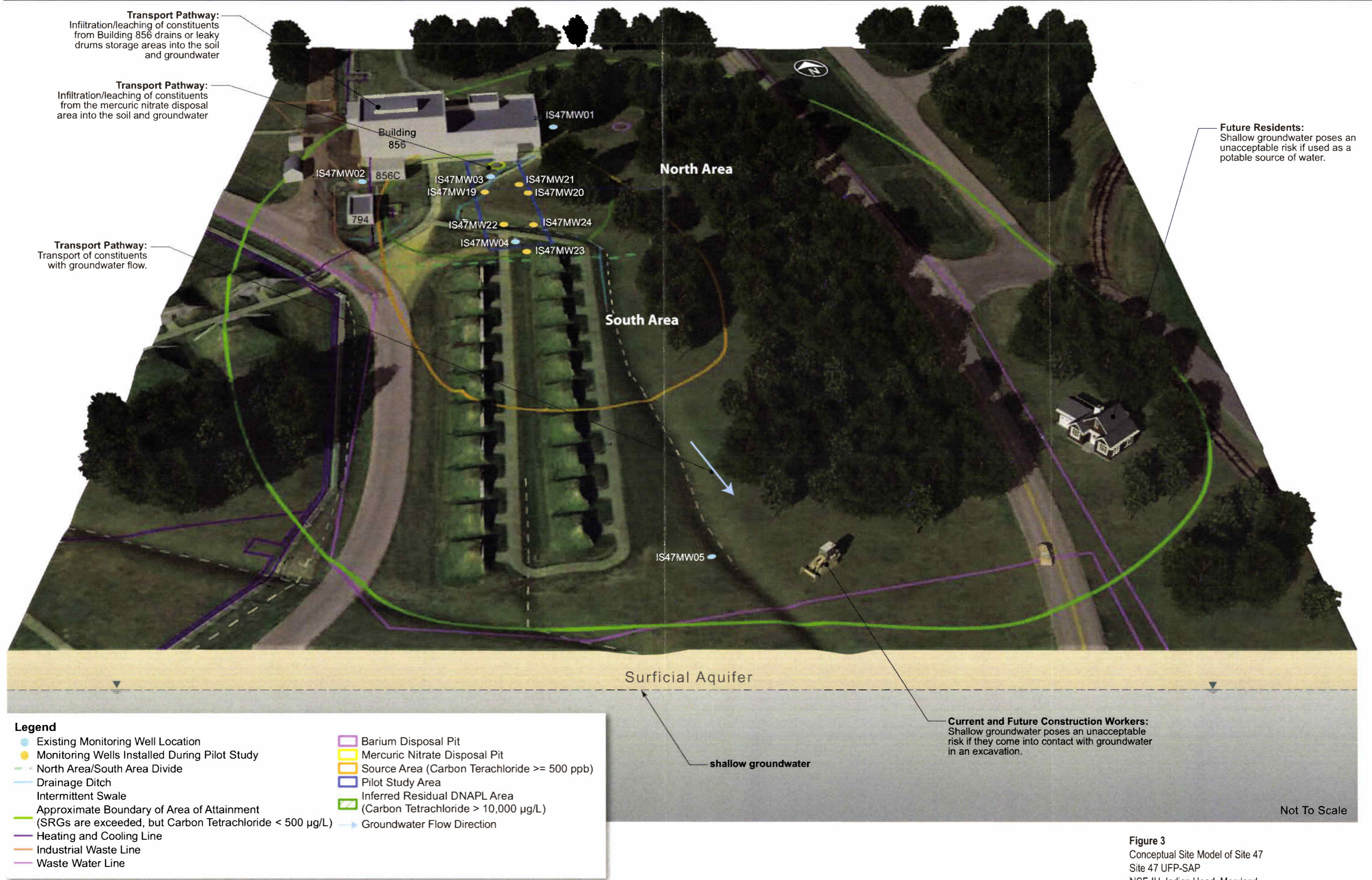
**Legend**

- Existing Monitoring Well Location
- North Area/South Area Divide
- Drainage Ditch
- Intermittent Swale
- Approximate Boundary of Area of Attainment (SRGs are exceeded, but Carbon Tetrachloride < 500 µg/L)
- Heating and Cooling Line
- Industrial Waste Line
- Waste Water Line
- Barium Disposal Pit
- Mercuric Nitrate Disposal Pit
- Source Area (Carbon Tetrachloride ≥ 500 ppb)
- Pilot Study Area
- ▨ Inferred Residual DNAPL Area (Carbon Tetrachloride > 10,000 µg/L)

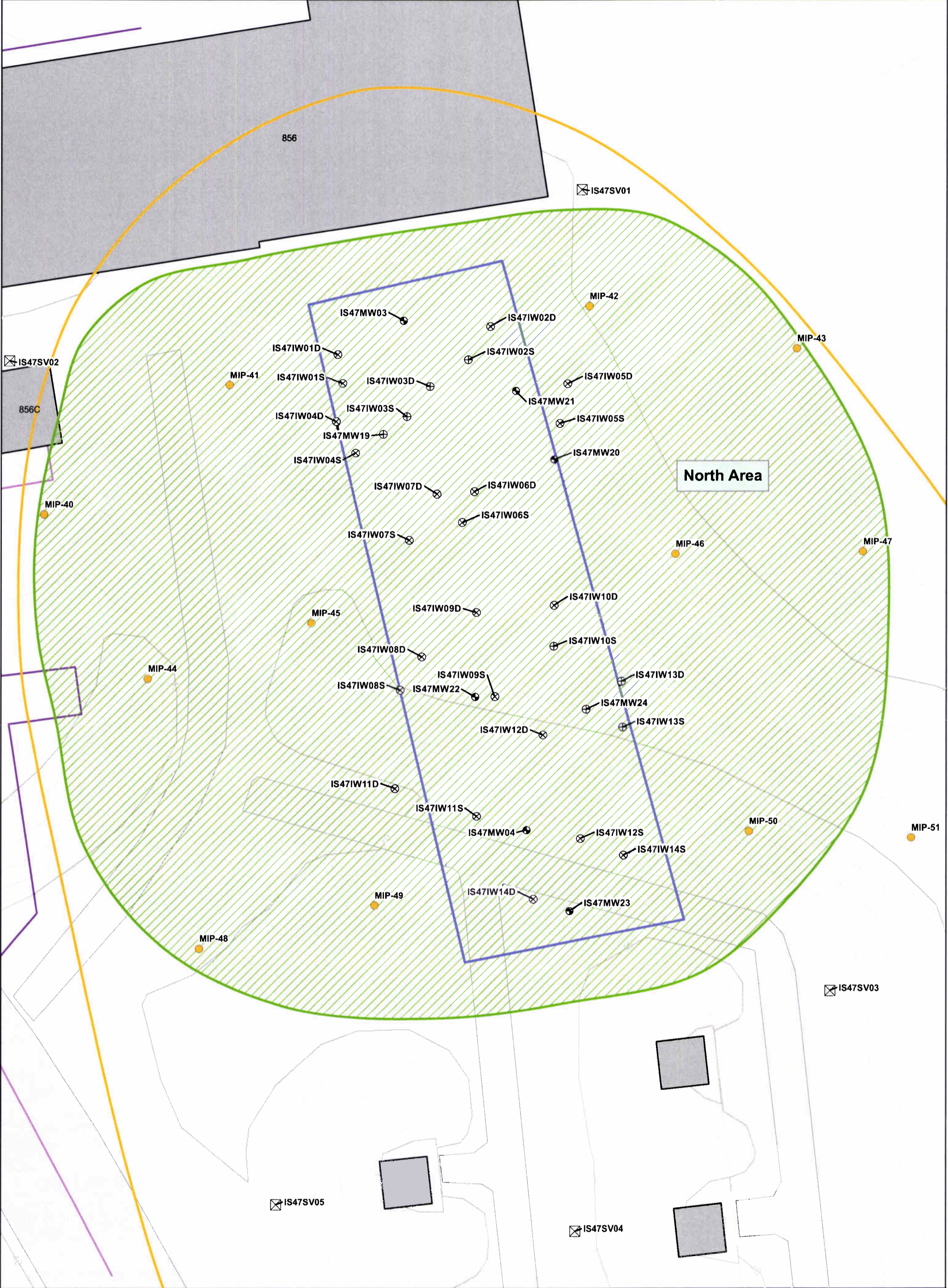


0 30 60  
Feet

Figure 2  
Site Layout  
Site 47 UFP-SAP  
NSF-IH, Indian Head, Maryland



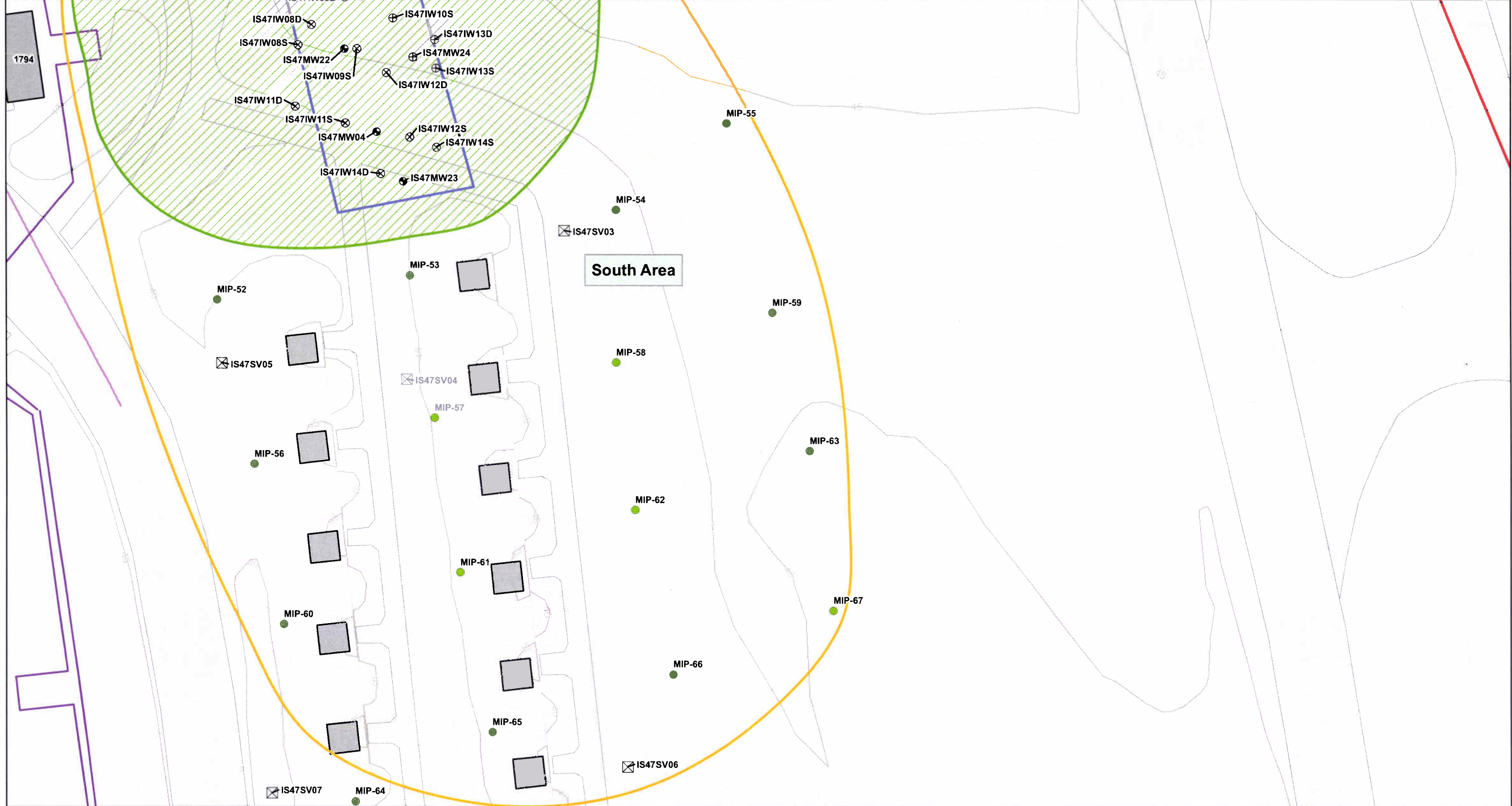
**Figure 3**  
Conceptual Site Model of Site 47  
Site 47 UFP-SAP  
NSF-IH, Indian Head, Maryland



- Legend**
- MIP Location
  - Existing Monitoring Well Location
  - Existing Permanent Injection Wells
  - Passive Soil Gas Venting Locations
  - Elevation Contour Line (1 ft Interval)
  - Elevation Contour Line (5 ft Interval)
  - Heating and Cooling Line
  - Waste Water Line
  - Pilot Study Area
  - Source Area (Carbon Terachloride  $\geq 500$  ppb)
  - Inferred Residual DNAPL Area (North Area)
  - Road
  - Building

Notes:  
1. North Area has CT concentrations exceeding 10,000  $\mu\text{g/L}$ .  
2. South Area has CT concentrations ranging from 500  $\mu\text{g/L}$  to 10,000  $\mu\text{g/L}$ .

Figure 4  
MIP Locations in the North Area  
Site 47 UFP-SAP  
NSF-IH, Indian Head, Maryland



- Legend**
- MIP Location
  - Existing Monitoring Well Location
  - Existing Permanent Injection Wells
  - Passive Soil Gas Venting Locations
  - Elevation Contour Line (1 ft Interval)
  - Elevation Contour Line (5 ft Interval)
  - Heating and Cooling Line
  - Waste Water Line
  - Pilot Study Area
  - Source Area (Carbon Tetrachloride >= 500 ppb)
  - Residual DNAPL Area (North Area)
  - Building
  - Road
  - IR Site Boundary

Notes:  
1. North Area has carbon tetrachloride concentrations exceeding 10,000 µg/L.  
2. South Area has carbon tetrachloride concentrations ranging from 500 µg/L to 10,000 µg/L.

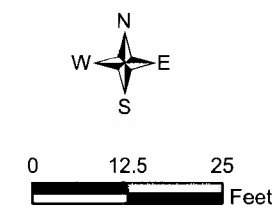
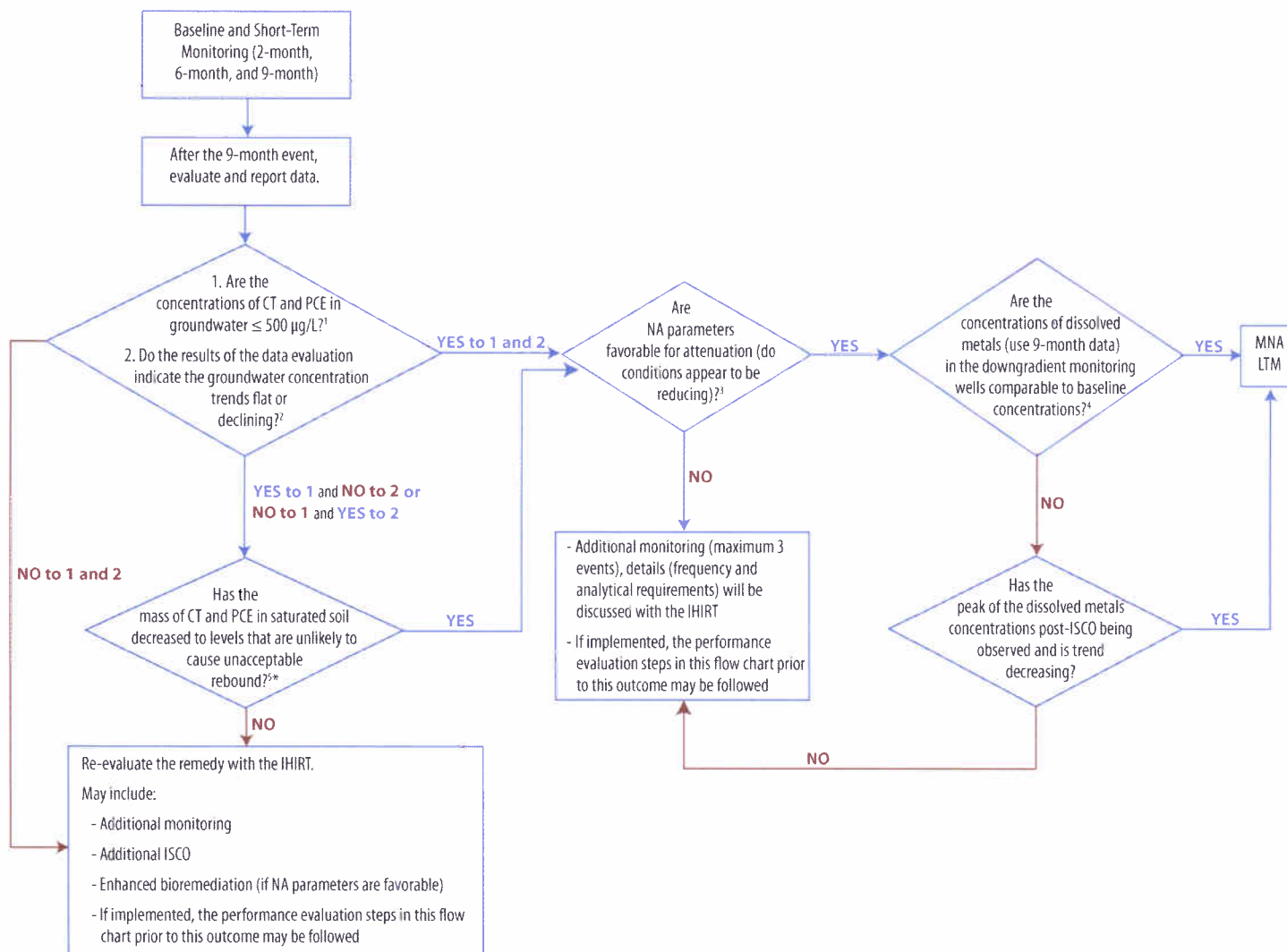


Figure 5  
MIP Locations in the South Area  
Site 47 UFP-SAP  
NSF-IH, Indian Head, Maryland



#### Notes:

<sup>1</sup> Concentrations of CT and PCE in groundwater will be evaluated using point-to-point and average concentration comparisons of wells within the treatment area to 500 µg/L.

<sup>2</sup> Data evaluation of groundwater trends within the treatment area will be statistically evaluated as follows:

-Trend evaluation using the Mann-Kendall test will be performed on every monitoring well within the treatment area. Trend evaluation for each well will show if the concentrations are exhibiting no significant trend or significant decreases.

-Analysis of variance (ANOVA) will be used to analyze the data on grouped wells to test for significant differences between events. Other statistical tools that will be used are post-hoc analysis and graphical evaluation to determine the relative order any significant differences (e.g. for a given constituent events 1 and 2 maybe be found to not differ significantly, but event 3 may be significantly lower than the first two events and event 4, may be significantly lower than the first three events.

-The data will be surveyed to determine whether any outliers are sufficiently unusual to be removed from the dataset or whether the evaluation should be performed with and without the unusual values.

<sup>3</sup> Natural attenuation (NA) parameters are listed in Section 2.5 of this UFP-SAP. They will be evaluated in accordance with Note 1 above, Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water (EPA, 1998), and Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents (NAVFAC, 2004).

<sup>4</sup> Concentrations of four indicator metals (cadmium, chromium, lead, and nickel) in groundwater will be evaluated using point-to-point and average concentration comparisons of wells within the treatment area to baseline concentrations.

<sup>5</sup> Saturated soil data will be used to support the evaluation of the groundwater remedy effectiveness. The theoretical equilibrium partition coefficients and actual site-specific partition coefficients after 9-months post-injection will be used to back calculate expected groundwater concentrations as a results of desorption/rebound on monitoring wells within the treatment area. Calculated results  $\geq 500$  µg/L may indicate that potential rebound may be unacceptable.

\*Use all data from baseline and short-term monitoring events

FIGURE 6  
Performance Evaluation Decision Tree  
Site 47 UFP-SAP  
NSF-IH, Indian Head, Maryland

**Appendix A**  
**Laboratory-specific Information**

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**Table A1-1 – Reference Limits and Evaluation Table**

**Analytical Group:** Select VOC

**Matrix:** Groundwater and Aqueous (Blanks)

Analyte	CAS No.	Site Remediation Goals (µg/L)	Project QL Goal <sup>1,2</sup> (µg/L)	Laboratory Specific Limits (µg/L)			Accuracy Control Limit (%R) <sup>3</sup>		Precision Control Limit (% RPD)
				LOQs	LODs	DLs			
1,1,2,2-Tetrachloroethane	79-34-5	20	10	1	1	0.54	65	130	30
Carbon disulfide	75-15-0	1324	662	5	5	1.9	35	160	30
Carbon tetrachloride	56-23-5	5	2.5	1	1	0.65	65	140	30
Chloroform	67-66-3	80	40	1	1	0.54	65	135	30
cis-1,2-Dichloroethene	156-59-2	72	36	1	1	0.49	70	125	30
Tetrachloroethene	127-18-4	5	2.5	1	1	0.76	45	150	30
1,2-Dichloroethane	156-60-5	5	2.5	1	1	0.50	60	140	30
Trichloroethene	79-01-6	5	2.5	1	1	0.55	70	125	30
Vinyl chloride	75-01-4	2	1	1	1	0.71	50	145	30

<sup>1</sup>The Project Action limit is the "Site Remediation Goal".

<sup>2</sup>The Project QL Goal is 1/2 the PAL, the PAL, or the Laboratory Specific LOQ, as applicable.

<sup>3</sup>DoD QSM v. 4.2 is the basis for LCS and MS/MSD limits.

**Table A1-2 – Reference Limits and Evaluation Table**

**Analytical Group:** METAL, FMETAL

**Matrix:** Groundwater and Aqueous (Blanks)

Analyte	CAS No.	Site Remediation Goals (µg/L)	Project QL Goal <sup>2,3</sup> (µg/L)	Laboratory-Specific Limits (µg/L)			Accuracy Control Limit (%R) <sup>4</sup>		Precision Control Limit (% RPD)
				LOQs	LODs	DLs			
Aluminum	7429-90-5	NC <sup>1</sup>	100	100	25.0	6.80	80	120	20
Antimony	7440-36-0	NC <sup>1</sup>	2	2.00	0.420	0.110	80	120	20
Arsenic	7440-38-2	147	73.5	20.0	10.0	0.610	80	120	20
Barium	7440-39-3	NC <sup>1</sup>	100	100	6.00	2.00	80	120	20
Beryllium	7440-41-7	NC <sup>1</sup>	1	1.00	0.370	0.0940	80	120	20
Cadmium	7440-43-9	NC <sup>1</sup>	8	8.00	4.00	0.110	80	120	20
Calcium	7440-70-2	NC <sup>1</sup>	600	600	300	36.0	80	120	20
Chromium	7440-47-3	NC <sup>1</sup>	6	6.00	3.00	0.450	80	120	20
Cobalt	7440-48-4	NC <sup>1</sup>	10	10.0	0.840	0.210	80	120	20
Copper	7440-50-8	NC <sup>1</sup>	10	10.0	0.880	0.220	80	120	20
Iron	7439-89-6	61100	30550	50.0	15.0	3.80	80	120	20
Lead	7439-92-1	NC <sup>1</sup>	5	5.00	0.600	0.160	80	120	20
Magnesium	7439-95-4	NC <sup>1</sup>	1000	1000	120	30.0	80	120	20
Manganese	7439-96-5	NC <sup>1</sup>	10	10.0	0.800	0.320	80	120	20
Nickel	7440-02-0	NC <sup>1</sup>	10	10.0	0.900	0.320	80	120	20
Potassium	7440-09-7	NC <sup>1</sup>	1000	1000	500	48.0	80	120	20
Selenium	7782-49-2	NC <sup>1</sup>	10	10.0	2.00	0.650	80	120	20
Silver	7440-22-4	NC <sup>1</sup>	1	1.00	0.120	0.0290	80	120	20
Sodium	7440-23-5	NC <sup>1</sup>	1000	1000	120	32.0	80	120	20
Thallium	7440-28-0	6.5	3.25	1.00	0.160	0.0580	80	120	20
Vanadium	7440-62-2	239	119.5	10.0	0.680	0.200	80	120	20
Zinc	7440-66-6	NC <sup>1</sup>	50	50.0	6.00	1.60	80	120	20

<sup>1</sup>NC: No screening level for this compound. Ca, Mg, K, and Na are nutrients.

<sup>2</sup>The Project Action limit is the "Site Remediation Goal".

<sup>3</sup>The Project QL Goal is 1/2 the PAL, the PAL, or the Laboratory Specific LOQ, as applicable.

<sup>4</sup>DoD QSM v. 4.2 is the basis for LCS and MS/MSD limits.

**Table A1-3 – Reference Limits and Evaluation Table**

**Analytical Group:** WCHEM

**Matrix:** Groundwater

Analyte	CAS No.	Project QL Goal <sup>2,3</sup> (µg/L)	Laboratory Specific Limits (µg/L)		
			LOQs	LODs	DLs
Total organic carbon (TOC)	TOC	1.0	1.0	0.66	0.22
Sulfate	14808-79-8	5.0	5.0	0.26	0.066
Sulfide	18496-25-8	1.0	1.0	1.0	0.45
Nitrate	14797-55-8	1.0	1.0	0.21	0.052
Alkalinity	471-34-1	10	10	5.7	1.9
Methane	74-82-8	1000	1000	964	720
Ethane	74-84-0	2000	2000	1960	1000
Ethene	74-85-1	3000	3000	2710	2300

<sup>1</sup>There are no screening levels or project action limits applicable to WCHEM data. The project quantitation limit goal is the laboratory specific LOQ.

<sup>2</sup>These CAS numbers are contractor-specific.

**Table A1-4 – Reference Limits and Evaluation Table**

**Analytical Group:** MICRO

**Matrix:** Groundwater

Analyte	CAS No.	Project QL Goal <sup>2,3</sup> (cells/mL)	Laboratory Specific Limits (cells/mL)		
			LOQs	LODs	DLs
Dehalobacter	DHB	3000	3000	100	100
Dehalococcoides	DHC	500	500	100	100
Sulfate Reducing Bacteria	SRB	1000	1000	100	100

<sup>1</sup>There are no screening levels or project action limits applicable to MICRO data. The project quantitation limit goal is the Laboratory Specific LOQ.

<sup>2</sup>These CAS numbers are contractor-specific.

**Table A1-5 – Reference Limits and Evaluation Table**

**Analytical Group:** VOC

**Matrix:** Subsurface Soil

Analyte	CAS No.	Evaluation Limit (µg/kg)	Project QL Goal <sup>1,2</sup> (µg/kg)	Laboratory Specific Limits (µg/kg)			Accuracy Control Limit (%R) <sup>3</sup>		Precision Control Limit (% RPD)
				LOQs	LODs	DLs			
1,1,2,2-Tetrachloroethane	79-34-5	5.53	2.77	1	1	0.3	65	130	30
Carbon disulfide	75-15-0	211.77	105.89	5	5	1.4	35	160	30
Carbon tetrachloride	56-23-5	2.77	1.39	1	1	0.6	65	140	30
Chloroform	67-66-3	15.96	7.98	1	1	0.4	65	135	30
cis-1,2-Dichloroethene	156-59-2	8.95	4.48	1	1	0.5	70	125	30
Tetrachloroethene	127-18-4	4.76	2.38	1	1	0.3	45	150	30
1,2-Dichloroethane	156-60-5	0.77	0.77	1	1	0.3	60	140	30
Trichloroethene	79-01-6	1.70	1.70	1	1	0.5	70	125	30
Vinyl chloride	75-01-4	0.4	0.4	1	1	0.4	50	145	30

Shading indicates cells where the LOD is greater than the PQL Goal. Refer to Section 2.6 "How good must the data be. ...".

<sup>1</sup>There are no Project Action Limits or Site Remediation Goals" for soil.

<sup>2</sup>The Project QL Goal is 1/2 the evaluation limit, the evaluation limit, or the laboratory specific LOQ, as applicable.

<sup>3</sup>DoD QSM v. 4.2 is the basis for LCS and MS/MSD limits.

**Table A1-6 – Reference Limits and Evaluation Table**

**Analytical Group:** METAL

**Matrix:** Subsurface Soil

Analyte	CAS No.	Project QL Goal <sup>1</sup> (mg/kg)	Laboratory Specific Limits (mg/kg)			Accuracy Control Limit (%R) <sup>2</sup>		Precision Control Limit (% RPD)
			LOQs	LODs	DLs			
Aluminum	7429-90-5	40	40	20	5.2	80	120	20
Antimony	7440-36-0	0.5	0.5	0.3	0.2	80	120	20
Arsenic	7440-38-2	20	20	10	0.51	80	120	20
Barium	7440-39-3	10	10	3.5	1.1	80	120	20
Beryllium	7440-41-7	2	2	0.3	0.1	80	120	20
Cadmium	7440-43-9	8	8	4	0.13	80	120	20
Calcium	7440-70-2	600	600	300	18	80	120	20
Chromium	7440-47-3	10	10	5	0.55	80	120	20
Cobalt	7440-48-4	1	1	0.6	0.14	80	120	20
Copper	7440-50-8	2	2	1	0.22	80	120	20
Iron	7439-89-6	14	14	7	1.7	80	120	20
Lead	7439-92-1	5	5	1	0.24	80	120	20
Magnesium	7439-95-4	220	220	110	28	80	120	20
Manganese	7439-96-5	2.4	2.4	1.2	0.28	80	120	20
Mercury	7439-97-6	0.0162	0.0162	0.0057	0.0019	80	120	20
Nickel	7440-02-0	1.2	1.2	0.6	0.25	80	120	20
Potassium	7440-09-7	1000	1000	500	29	80	120	20
Selenium	7782-49-2	7	7	3.5	0.91	80	120	20
Silver	7440-22-4	0.5	0.5	0.08	0.033	75	120	20
Sodium	7440-23-5	400	400	200	47	80	120	20
Thallium	7440-28-0	1	1	0.15	0.037	80	120	20
Vanadium	7440-62-2	2	2	1	0.22	80	120	20
Zinc	7440-66-6	10	10	5	1.3	80	120	20

<sup>1</sup>Since there are no PALs for SB METAL, the Project QL Goal is the Laboratory Specific LOQ.

<sup>2</sup>DoD QSM v. 4.2 is the basis for LCS and MS/MSD limits.

**Table A1-7 – Reference Limits and Evaluation Table**

**Analytical Group:** WCHEM

**Matrix:** Surface Soil

Analyte	CAS No. <sup>2</sup>	Project QL Goal <sup>1</sup>	Laboratory Specific Limits		
			LOQs	LODs	DLs
Total organic carbon (TOC)	TOC	500	500 (mg/kg)	500 (mg/kg)	500 (mg/kg)

<sup>1</sup>There are no screening levels or project action limits applicable to WCHEM data. The project quantitation limit goal is the Laboratory Specific LOQ.

<sup>2</sup>These CAS numbers are contractor-specific.

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Table A2-1 - Analytical SOP References Table

Laboratory Name: ENCO Laboratories  
Address: 10775 Central Port Drive  
Orlando, FL 32824  
Point of Contact: Ronnie Wambles  
Phone Number: (407) 826-5314

Lab SOP Number	Title, Revision Date, and / or Number	Date Last Revisited if not Revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? <sup>1</sup>
LOGINS-03	RECEIVING SAMPLES (Rev. 10, Effective 1/23/2010)	Review	NA	Various	NA	None	None
ADMIN-14	WASTE DISPOSAL AND CHARACTERIZATION (Rev. 5, 12/1/2009)	Review	NA	Various	NA	None	None
MET-15	METAL ANALYSIS USING INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY (ICP-MS) ( Revision 5, Effective 02/14/2011)	2/1/2012	Definitive	SS, SB, AQ, GW / METAL, FMETAL	ICP-MS	None	None
VGCMS-05	Analysis of Volatile Organic Compounds by GCMS (Rev.17, Effective 08/26/2011)	NA	Definitive	SS, SB, AQ, GW / VOC	GCMS	None	None
EXMT-07	Acid Digestion of AQ, GW Samples & Extracts for Analysis by ICP OR ICP-MS (Rev. 7, 08/23/2011)	NA	NA	AQ, GW / METAL, FMETAL	Block Digester	None	None
EXMT-09	Acid Digestion of SS, SB and Waste Samples for Analysis by ICP and ICP-MS (Rev. 6, 08/31/2011)	NA	NA	SS, SB / METAL	Block Digester	None	None
WETS-90	Total Organic Carbon in SS, SB Using Walkley Black Titration (Rev. 1, Effective 01/12/2010)	4/20/2011	Screening	SS / WCHEM	NA	None	None
WETS-66	TOTAL AND DISSOLVED ORGANIC CARBON BY COMBUSTION-INFRARED METHOD USING THE TEKMAR APOLLO 9000 TOC COMBUSTION ANALYZER (Rev. 4, Effective 01/26/2010)	Review	Screening	GW / WCHEM	TOC Analyzer	None	None
WETS-061	SULFIDE (TITRIMETRIC) (Rev. 4, 05/21/2009)	Review	Screening	GW / WCHEM	Spectrophotometer	None	None
WETS-057	ION CHROMATOGRAPHY (Rev. 5, Effective 01/28/2010)	Review	Screening	GW / WCHEM	Ion Chromatograph	None	None
WETS-047	ALKALINITY (METHYL ORANGE, AUTOMATED) (Rev. 2, 06/21/2011)		Screening	GW / WCHEM	NA	None	None

SOP is currently in-review at time of preparation of this Table. This Table was prepared 04/10/12.

<sup>1</sup>If yes, then specify the modification that has been made. Note that any analytical SOP modification made relative to project specific needs must be reviewed and approved by the Navy QAO.

Table A2-2 - Analytical SOP References Table

Laboratory Name: ENCO Laboratories  
Address: 4810 Executive Park Court, Suite 211  
Jacksonville, FL 32216  
Point of Contact: Ronnie Wambles  
Phone Number: (407) 826-5314

Lab SOP Number	Title, Revision Date, and / or Number	Date Last Revisited if not Revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? <sup>1</sup>
VGC-11	ANALYSIS OF DISSOLVED GASES BY HEADSPACE GC/TCD/FID (Rev. 5, Effective 06/24/2011)		Screening	GW / WCHEM	GC/FID	None	None

This Table was prepared 04/10/12.

<sup>1</sup>If yes, then specify the modification that has been made. Note that any analytical SOP modification made relative to project specific needs must be reviewed and approved by the Navy QAO.

Table A2-3 - Analytical SOP References Table

Laboratory Name: Microbial Insights, Inc.  
Address: 2340 Stock Creek Blvd.  
Rockford, TN 37853  
Point of Contact: Anita Biernacki  
Phone Number: (865) 573-8188

Lab SOP Number	Title, Revision Date, and / or Number	Date Last Revisited if not Revised	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? <sup>1</sup>
DNA-qPCR	Quantitative Polymerase Chain Reaction (qPCR), 1/10/06, Rev 1.0	Review	Screening	GW / MICRO	PCR System	None	None
DNA-EXT	Extraction of DNA from Environmental Samples (Matrix- Water, Soil, Biofilm, Bio-Sep Beads), 1/5/06, Rev 1.0	Review	N/A	N/A	Not applicable	None	None
Waste Disposal	Waste Disposal, 3/1/08, Rev 1.0	Review	N/A	N/A	Not applicable	None	None

SOP is currently in-review at time of preparation of this Table. This Table was prepared 04/10/12.

<sup>1</sup>If yes, then specify the modification that has been made. Note that any analytical SOP modification made relative to project specific needs must be reviewed and approved by the Navy QAO.

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**Table A3-1 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** VOC

**Analytical Method / SOP Reference:** SW-846 8260B / VGCMS-05

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.2. Reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).
Laboratory Control Sample	One per preparatory batch.	Refer to Table A1-1. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.2. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Table A1-1. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.

**Table A3-1 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** VOC

**Analytical Method / SOP Reference:** SW-846 8260B / VGCMS-05

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Table A1-1.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Table A1-1.
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time $\pm 30$ seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS.	Analyst	Accuracy	Retention time $\pm 30$ seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.

**Table A3-1 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** VOC

**Analytical Method / SOP Reference:** SW-846 8260B / VGCMS-05

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogates	4 Per Sample	1,2-Dichloroethane-d4: 70-120%R 4-Bromofluorobenzene: 75-120%R Dibromofluoromethane: 85-115%R Toluene-d8: 85-120%R	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	1,2-Dichloroethane-d4: 70-120%R 4-Bromofluorobenzene: 75-120%R Dibromofluoromethane: 85-115%R Toluene-d8: 85-120%R

<sup>1</sup>DoD QSM v. 4.2 is the basis for specifications on this table.

**Table A3-2 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** METAL, FMETAL

**Analytical Method / SOP Reference:** SW-846 6020A / EXMT-07, MET-15

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.2. Reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOD.

**Table A3-2 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** METAL, FMETAL

**Analytical Method / SOP Reference:** SW-846 6020A / EXMT-07, MET-15

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Interference Check Solutions (ICS)	At the beginning of an analytical run.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes)  ICS-AB: Within $\pm 20\%$ of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS.	Analyst	Accuracy/Bias	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes)  ICS-AB: Within $\pm 20\%$ of true value.
Laboratory Control Sample	One per preparatory batch.	Refer to Table A1-2. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.2. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Table A1-2. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.

**Table A3-2 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** METAL, FMETAL

**Analytical Method / SOP Reference:** SW-846 6020A / EXMT-07, MET-15

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Table A1-2.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Table A1-2.
Serial Dilution	One per preparatory batch.	Five-fold dilution must agree within $\pm 10\%$ of the original measurement. Only applicable for samples with concentrations > 50X LOQ.	Perform post-digestion spike (PDS) addition.	Analyst	Accuracy	Five-fold dilution must agree within $\pm 10\%$ of the original measurement. Only applicable for samples with concentrations > 50X LOQ.
Post-digestion Spike (PDS)	When dilution test fails or analyte concentration in all samples < 50X LOD.	75-125%R	Run all associated samples in the preparatory batch by method of standard additions (MSA). Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	75-125%R

<sup>1</sup>DoD QSM v. 4.2 is the basis for specifications on this table.

**Table A3-3 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** WCHEM

**Analytical Method / SOP Reference:** EPA 300.0, SM4500-S2-F, RSK-175, SW-846 9060, SM2320B / WETS-057, WETS-061, VCG-11, WETS-66, WETS-047

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
<b>Nitrate and Sulfate by EPA 300.0</b>						
Method Blank	One per batch	< 1/2 LOQ or <1/10 the concentration found in the sample	Investigate source of contamination. Rerun method blank.	Analyst, Laboratory Supervisor	Bias/Contamination	< 1/2 LOQ or <1/10 the concentration found in the sample
Laboratory Control Sample (LCS)	One per batch of 20 or fewer samples	90-110% recovery	Reanalyze. Investigate standards and recalibrate if necessary.	Analyst, Laboratory Supervisor	Accuracy/Bias	90-110% recovery
Laboratory Control Sample Duplicate (LCSD)	If no MSD in batch	Same as LCS, RPD ≤20%	Same as LCS	Analyst, Laboratory Supervisor	Accuracy, Bias, Precision	Same as LCS, RPD ≤20%
Matrix Spike	If deemed necessary by the laboratory	80-120% recovery	Advisory. Reanalysis may be done unless obvious matrix issues.	Analyst, Laboratory Supervisor	Accuracy/Bias	80-120% recovery
Matrix Spike Duplicate	If deemed necessary by the laboratory	Same as MS, RPD ≤20%	Advisory. Reanalysis may be done unless obvious matrix issues.	Analyst, Laboratory Supervisor	Accuracy, Bias, Precision	Same as MS, RPD ≤20%
<b>Sulfide by SM4500-S2-F</b>						
Method Blank	One per batch	< 1/2 LOQ or <1/10 the concentration found in the sample	Investigate source of contamination. Rerun method blank.	Analyst, Laboratory Supervisor	Bias/Contamination	< 1/2 LOQ or <1/10 the concentration found in the sample
Laboratory Control Sample (LCS)	One per batch of 20 or fewer samples	80-120% recovery	Reanalyze. Investigate standards and recalibrate if necessary.	Analyst, Laboratory Supervisor	Accuracy	80-120% recovery
Laboratory Control Sample Duplicate (LCSD)	If no MSD in batch	Same as LCS, RPD ≤20%	Same as LCS	Analyst, Laboratory Supervisor	Accuracy, Precision	Same as LCS, RPD ≤20%

**Table A3-3 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** WCHEM

**Analytical Method / SOP Reference:** EPA 300.0, SM4500-S2-F, RSK-175, SW-846 9060, SM2320B / WETS-057, WETS-061, VCG-11, WETS-66, WETS-047

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike (MS)	One per batch of 20 or fewer samples	75-125% recovery	Advisory. Reanalysis may be done unless obvious matrix issues.	Analyst, Laboratory Supervisor	Accuracy	75-125% recovery
Matrix Spike Duplicate (MSD)	One per batch of 20 or fewer samples	Same as MS, RPD ≤20%	Same as MS.	Analyst, Laboratory Supervisor	Accuracy, Precision	Same as MS, RPD ≤20%
Laboratory Replicate	One per batch	RPD ≤20%	Reanalyze.	Analyst, Laboratory Supervisor	Precision	RPD ≤20%
<b>Dissolved Gasses by RSK-175</b>						
Method Blank	One per batch of 20 or fewer samples	< 1/2 LOQ or <1/10 the concentration found in the sample	Reanalyze if sample volume remains or qualify.	Analyst, Laboratory Supervisor	Bias/Contamination	< 1/2 LOQ or <1/10 the concentration found in the sample
Laboratory Control Sample (LCS)	One per batch of 20 or fewer samples	80-120% recovery	Reanalyze. Investigate standards and recalibrate if necessary.	Analyst, Laboratory Supervisor	Accuracy	80-120% recovery
Laboratory Control Sample Duplicate (LCSD)	If no MSD in batch	Same as LCS, RPD ≤30%	Same as LCS	Analyst, Laboratory Supervisor	Accuracy, Precision	Same as LCS, RPD ≤30%
Matrix Spike (MS)	One per batch of 20 or fewer samples	75-125% recovery	CA will not be taken for samples when recoveries are outside limits and LCS criteria are met. If both the LCS and MS/MSD are unacceptable reanalyze samples and QC.	Analyst, Laboratory Supervisor	Accuracy	75-125% recovery

**Table A3-3 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** WCHEM

**Analytical Method / SOP Reference:** EPA 300.0, SM4500-S2-F, RSK-175, SW-846 9060, SM2320B / WETS-057, WETS-061, VCG-11, WETS-66, WETS-047

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike Duplicate (MSD)	One per batch of 20 or fewer samples	Same as MS, RPD ≤30%	Same as MS.	Analyst, Laboratory Supervisor	Accuracy, Precision	Same as MS, RPD ≤30%
<b>Total Organic Carbon by SW-846 9060</b>						
Method Blank	One per batch of 20 or fewer samples	< 1/2 LOQ or <1/10 the concentration found in the sample	Investigate source of contamination. Rerun method blank.	Analyst, Laboratory Supervisor	Bias/Contamination	< 1/2 LOQ or <1/10 the concentration found in the sample
Laboratory Control Sample (LCS)	One per batch of 20 or fewer samples	80-120% recovery	Reanalyze. Investigate standards and recalibrate if necessary.	Analyst, Laboratory Supervisor	Accuracy/Bias	80-120% recovery
Laboratory Control Sample Duplicate (LCSD)	If no MSD in batch	Same as LCS, RPD ≤20%	Same as LCS	Analyst, Laboratory Supervisor	Accuracy, Bias, Precision	Same as LCS, RPD ≤20%
Laboratory Duplicate	One per batch	RPD ≤20%	Advisory. Reanalysis may be done unless obvious matrix issues.	Analyst, Laboratory Supervisor	Precision	RPD ≤20%
Matrix Spike	One per batch of 20 or fewer samples	75-125% recovery	CA will not be taken for samples when recoveries are outside limits and LCS criteria are met. If both the LCS and MS/MSD are unacceptable reanalyze samples and QC.	Analyst, Laboratory Supervisor	Accuracy/Bias	75-125% recovery
Matrix Spike Duplicate (MSD)	One per batch of 20 or fewer samples	Same as MS, RPD ≤20%	Same as MS.	Analyst, Laboratory Supervisor	Accuracy/Precision	Same as MS, RPD ≤20%

**Table A3-3 – Laboratory QC Samples Table**

**Matrix:** Groundwater and Aqueous (Blanks)

**Analytical Group:** WCHEM

**Analytical Method / SOP Reference:** EPA 300.0, SM4500-S2-F, RSK-175, SW-846 9060, SM2320B / WETS-057, WETS-061, VCG-11, WETS-66, WETS-047

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
<b>Alkalinity by SM2320B</b>						
Method Blank	One per preparatory batch	Result < LOQ	Reanalyze samples	Analyst/Supervisor	Bias/Contamination	Result < LOQ
Laboratory Control Sample	One per preparatory batch	80-120%	If LCS is out high and sample concentrations are < LOQ, no CA. Otherwise all samples must be reanalyzed	Analyst/Supervisor	Accuracy/Bias	80-120%
Sample Duplicate	One per preparatory batch	RPD ≤20%	If RPD > 20%, sample should be reanalyzed. If still high, result is flagged.	Analyst/Supervisor	Precision	RPD ≤20%

<sup>1</sup>In-house laboratory limits were the basis for measurement performance criteria.

**Table A3-4 – Laboratory QC Samples Table**

**Matrix:** Groundwater

**Analytical Group:** MICRO

**Analytical Method / SOP Reference:** qPCR / DNA-EXT, DNA-qPCR

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Assay Negative Control (Blank)	1 per analytical assay plate	Values for positive samples are set above any fluorescence for the negative control.	Rerun assay; may have to reoptimize assay.	Analyst	Accuracy/Bias, Contamination	Values for positive samples are set above any fluorescence for the negative control.
DNA extraction negative control	1 per analytical batch	CT ≤ Assay Negative Control	Rerun assay or reextract samples if problem persists	Analyst	Accuracy/Bias	CT ≤ Assay Negative Control
Positive Control	1 per analytical assay plate	CT value within 2 units of same point on standard curve	Rerun assay / check reagents	Analyst	Accuracy/Bias	CT value within 2 units of same point on standard curve

<sup>1</sup>In-house laboratory limits were the basis for measurement performance criteria.

**Table A3-5 – Laboratory QC Samples Table**

**Matrix:** Surface Soil and Subsurface Soil

**Analytical Group:** VOC

**Analytical Method / SOP Reference:** SW-846 8260B / VGCMS-05

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.2. Reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analytes(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).
Laboratory Control Sample	One per preparatory batch.	Refer to Table A1-5. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.2. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Table A1-5. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.

**Table A3-5 – Laboratory QC Samples Table**

**Matrix:** Surface Soil and Subsurface Soil

**Analytical Group:** VOC

**Analytical Method / SOP Reference:** SW-846 8260B / VGCMS-05

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Table A1-5.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Table A1-5.
Internal Standards Verification	Every field sample, standard, and QC sample.	Retention time $\pm 30$ seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS.	Analyst	Accuracy	Retention time $\pm 30$ seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.
Surrogates	2 Per Sample	4-Bromofluorobenzene: 85-120%R Toluene-d8: 85-115%R	For field and QC sample, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met.	Analyst	Accuracy/Bias	4-Bromofluorobenzene: 85-120%R Toluene-d8: 85-115%R

<sup>1</sup>DoD QSM v. 4.2 is the basis for specifications on this table.

**Table A3-6 – Laboratory QC Samples Table**

**Matrix:** Surface Soil and Subsurface Soil

**Analytical Group:** METAL

**Analytical Method / SOP Reference:** SW-846 6020A / EXMT-09, MET-15

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch.	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).	Correct problem, then see criteria in Box D-1 of DoD QSM v. 4.2. Reprep and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias, Contamination	No analytes detected > 1/2 RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1 of DoD QSM v 4.2).
Calibration Blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prepare and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	Analyst	Accuracy/Bias, Contamination	No analytes detected > LOD.
Interference Check Solutions (ICS)	At the beginning of an analytical run.	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes) ICS-AB: Within $\pm 20\%$ of true value.	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all samples. If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS.	Analyst	Accuracy/Bias	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spike analytes)  ICS-AB: Within $\pm 20\%$ of true value.

**Table A3-6 – Laboratory QC Samples Table**

**Matrix:** Surface Soil and Subsurface Soil

**Analytical Group:** METAL

**Analytical Method / SOP Reference:** SW-846 6020A / EXMT-09, MET-15

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Control Sample	One per preparatory batch.	Refer to Table A1-6. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to Appendix G of DoD QSM v. 4.2. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Analyst	Accuracy/Bias	Refer to Table A1-6. Limits are as per DoD QSM v. 4.2. In-house statistical laboratory limits are provided when DoD QSM v. 4.2 does not specify.
Matrix Spike	One per preparatory batch per matrix.	Same as LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control tests are required to evaluate matrix effects. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy/Bias	Same as LCS.
Matrix Spike Duplicate	One per preparatory batch per matrix.	Same as MS and refer to Table A1-6.	Same as MS	Analyst	Accuracy/Bias, Precision	Same as MS and refer to Table A1-6.
Serial Dilution	One per preparatory batch.	Five-fold dilution must agree within $\pm 10\%$ of the original measurement. Only applicable for samples with concentrations > 50X LOQ.	Perform post-digestion spike (PDS) addition.	Analyst	Accuracy	Five-fold dilution must agree within $\pm 10\%$ of the original measurement. Only applicable for samples with concentrations > 50X LOQ.

**Table A3-6 – Laboratory QC Samples Table**

**Matrix:** Surface Soil and Subsurface Soil

**Analytical Group:** METAL

**Analytical Method / SOP Reference:** SW-846 6020A / EXMT-09, MET-15

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post-digestion Spike (PDS)	When dilution test fails or analyte concentration in all samples < 50X LOD.	75-125%R	Run all associated samples in the preparatory batch by method of standard additions (MSA). Or, for the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst	Accuracy	75-125%R

<sup>1</sup>DoD QSM v. 4.2 is the basis for specifications on this table.

**Table A3-7 – Laboratory QC Samples Table**

**Matrix:** Surface Soil

**Analytical Group:** WCHEM (TOC)

**Analytical Method / SOP Reference:** Walkley Black / WETS-90

QC Sample <sup>1</sup>	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per prep batch	No analyte detected > 1/2 LOQ	Investigate source of contamination. Evaluate the samples and associated QC: i.e. If the blank results are above the PQL, report sample results which are <PQL or > 10X the blank concentration. Otherwise, reprep a blank and the remaining samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias, Contamination	No analyte detected > 1/2 PQL
Laboratory replicate	One laboratory replicate per twenty samples	RPD < 20	If lab QC in criteria and matrix interference suspected, flag data. Else, reanalyze	Analyst, Laboratory Department Manager and Data Validator	Precision	RPD < 20
Matrix Spike (MS)	One MS per ten samples	75-125% recovery	If LCS in criteria and matrix interference suspected, flag data. Else, reanalyze	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	75-125% recovery
Laboratory Control Sample (LCS)	One LCS per prep batch	80-120% recovery	Investigate source of problem. If the LCS recovery is high but the sample results are <LOQ, narrate. Otherwise, reprep a blank and the remaining samples.	Analyst, Laboratory Department Manager, and Data Validator	Accuracy/Bias	80-120% recovery

<sup>1</sup>In-house laboratory limits were the basis for measurement performance criteria.

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**Appendix B**  
**Laboratory Department of Defense Environmental**  
**Laboratory Accreditation Program Accreditation**  
**Letters**

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SCOPE OF ACCREDITATION TO ISO/IEC 17025-2005

ENVIRONMENTAL CONSERVATION LABORATORIES – JACKSONVILLE

4810 Executive Park Court, Suite 211

Jacksonville, FL 32216

Dr. Mark Inman Phone: 904 296 3007

Email address: minman@encolabs.com

ENVIRONMENTAL

Valid To: April 30, 2012

Certificate Number: 3000.02

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1)) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
Isopropyl alcohol (2-Propanol)	EPA 8015C	NA	ENCO VGCMS-07
4-Ethyltoluene	NA	NA	ENCO VGCMS-07
Cyclohexane	EPA 8260B	EPA 8260B	ENCO VGCMS-07
1,1,1-Trichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,2,2-Tetrachloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B	EPA 8260B	EPA TO-14A
1,1,2-Trichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1-Dichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1-Dichloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichloro-1,1,2,2-tetrafluoroethane	NA	NA	EPA TO-14A
1,3-Butadiene	NA	NA	EPA TO-15
1,4-Dioxane	EPA 8260B	EPA 8260B	EPA TO-15
2,2,4-Trimethylpentane	NA	NA	EPA TO-15
Benzyl chloride	NA	NA	EPA TO-15
n-Hexane	NA	NA	EPA TO-15

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
2-Hydroxy isobutyric acid	ENCO VGC-13	NA	NA
Acetic acid	ENCO VGC-13	NA	NA
Butyric acid (Butanoic acid)	ENCO VGC-13	NA	NA
Hexanoic acid	ENCO VGC-13	NA	NA
Isohexanoic acid (4-methyl-pentanoic acid)	ENCO VGC-13	NA	NA
Isopentanoic acid (3-methyl-butanoic acid)	ENCO VGC-13	NA	NA
Lactic acid	ENCO VGC-13	NA	NA
Pentanoic acid	ENCO VGC-13	NA	NA
Propionic acid (Propanoic acid)	ENCO VGC-13	NA	NA
Pyruvic acid	ENCO VGC-13	NA	NA
Propylene glycol	ENCO VGC-18	NA	NA
Ethyl acetate	EPA 8015C	NA	ENCO VGCMS-07
Ethylene glycol	EPA 8015C	NA	NA
Gasoline range organics (GRO)	EPA 8015C	EPA 8015C	NA
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8015C, 8260B	EPA 8260B	NA
Methanol	EPA 8015C	NA	NA
n-Butyl alcohol	EPA 8015C	NA	NA
n-Propanol	EPA 8015C	NA	NA
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504, 504.1, 8011, 8260	EPA 8260B	NA
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504, 504.1, 8011, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,2-Dichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichloropropane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,3-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,4-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
2-Chloroethyl vinyl ether	EPA 624, 8260B	EPA 8260B	NA
Acrolein (Propenal)	EPA 624, 8260B	EPA 8260B	NA
Acrylonitrile	EPA 624, 8260B	EPA 8260B	NA
Benzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Bromodichloromethane	EPA 624, 8260B	EPA 8260B	ENCO VGCMS-07
Bromoform	EPA 624, 8260B	EPA 8260B	EPA TO-15
Carbon tetrachloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chlorobenzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chloroform	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15

*Peter M. Rye*

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
cis-1,3-Dichloropropene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Dibromochloromethane	EPA 624, 8260B	EPA 8260B	ENCO VGCMS-07
Ethylbenzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methyl bromide (Bromomethane)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methyl chloride (Chloromethane)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methylene chloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Tetrachloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Toluene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
trans-1,2-Dichloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-15
trans-1,3-Dichloropropylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Trichloroethene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Trichlorofluoromethane	EPA 624, 8260B	EPA 8260B	EPA-TO-14A
Vinyl chloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Xylene (total)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,1,2-Tetrachloroethane	EPA 8260B	EPA 8260B	NA
1,1-Dichloropropene	EPA 8260B	EPA 8260B	NA
1,2,3-Trichlorobenzene	EPA 8260B	EPA 8260B	NA
1,2,3-Trichloropropane	EPA 8260B	EPA 8260B	NA
1,2,4-Trichlorobenzene	EPA 8260B, 625, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,2,4-Trimethylbenzene	EPA 8260B	EPA 8260B	EPA TO-14A
1,3,5-Trimethylbenzene	EPA 8260B	EPA 8260B	EPA TO-14A
1,3-Dichloropropane	EPA 8260B	EPA 8260B	NA
2,2-Dichloropropane	EPA 8260B	EPA 8260B	NA
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B, 8015	EPA 8260B	EPA TO-15
2-Chlorotoluene	EPA 8260B	EPA 8260B	NA
2-Hexanone	EPA 8260B	EPA 8260B	ENCO VGCMS-07
4-Chlorotoluene	EPA 8260B	EPA 8260B	NA
4-Methyl-2-pentanone (MIBK)	EPA 8260B, 8015C	EPA 8260B	EPA TO-15
Acetone	EPA 8260B	EPA 8260B	NA
Acetonitrile	EPA 8260B	EPA 8260B	NA
Allyl chloride (3-Chloropropene)	EPA 8260B	EPA 8260B	EPA TO-15
Bromobenzene	EPA 8260B	EPA 8260B	NA
Bromochloromethane	EPA 8260B	EPA 8260B	NA
Carbon disulfide	EPA 8260B	EPA 8260B	EPA TO-15
Chloroprene	EPA 8260B	EPA 8260B	NA
cis-1,2-Dichloroethylene	EPA 8260B	EPA 8260B	EPA TO-14A, EPA TO-15

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
Dibromomethane	EPA 8260B	EPA 8260B	NA
Dichlorodifluoromethane	EPA 8260B	EPA 8260B	EPA TO-14A
Ethanol	EPA 8260B, 8015	EPA 8260B	NA
Hexachlorobutadiene	EPA 8260B, 625, 8270D	EPA 8260, 8270	EPA TO-14A, EPA TO-15
Isopropylbenzene	EPA 8260B	EPA 8260B	NA
Methacrylonitrile	EPA 8260B	EPA 8260B	NA
Methyl methacrylate	EPA 8260B	EPA 8260B	NA
Methyl tert-butyl ether (MTBE)	EPA 8260B	EPA 8260B	EPA TO-15
m-Xylene	EPA 8260B	EPA 8260B	NA
Naphthalene	EPA 8260B, 625, 8270D, 8270D PAHSIM	EPA 8260B, 8270D, 8270D PAHSIM	NA
n-Butyl benzene	EPA 8260B	EPA 8260B	NA
n-Propyl benzene	EPA 8260B	EPA 8260B	NA
o-Xylene	EPA 8260B	EPA 8260B	NA
p-Isopropyltoluene	EPA 8260B	EPA 8260B	NA
Propionitrile (Ethyl cyanide)	EPA 8260B	EPA 8260B	NA
p-Xylene	EPA 8260B	EPA 8260B	NA
sec-Butylbenzene	EPA 8260B	EPA 8260B	NA
Styrene	EPA 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
tert-Butylbenzene	EPA 8260B	EPA 8260B	NA
trans-1,4-Dichloro-2-butene	EPA 8260B	EPA 8260B	NA
Vinyl acetate	EPA 8260B	EPA 8260B	EPA TO-15
4,4'-DDD	EPA 608, 8081B	EPA 8081B	NA
4,4'-DDE	EPA 608, 8081B	EPA 8081B	NA
4,4'-DDT	EPA 608, 8081B	EPA 8081B	NA
Aldrin	EPA 608, 8081B	EPA 8081B	NA
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	NA
Aroclor-1016(PCB-1016)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1221(PCB-1221)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1232(PCB-1232)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1242(PCB-1242)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1248(PCB-1248)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1254(PCB-1254)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1260(PCB-1260)	EPA 608, 8082A	EPA 8082A	NA
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	NA
Chlordane(tech.)	EPA 608, 8081B	EPA 8081B	NA
delta-BHC	EPA 608, 8081B	EPA 8081B	NA
Dieldrin	EPA 608, 8081B	EPA 8081B	NA
Endosulfan I	EPA 608, 8081B	EPA 8081B	NA
Endosulfan II	EPA 608, 8081B	EPA 8081B	NA
Endosulfan sulfate	EPA 608, 8081B	EPA 8081B	NA
Endrin	EPA 608, 8081B	EPA 8081B	NA
Endrin aldehyde	EPA 608, 8081B	EPA 8081B	NA
gamma-BHC (Lindane,gamma-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	NA
Heptachlor	EPA 608, 8081B	EPA 8081B	NA

*Peter M. Meyer*

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
Heptachlor epoxide	EPA 608, 8081B	EPA 8081B	NA
Toxaphene (Chlorinated camphene)	EPA 608, 8081B	EPA 8081B	NA
alpha-Chlordane	EPA 8081B	EPA 8081B	NA
Endrin ketone	EPA 8081B	EPA 8081B	NA
gamma-Chlordane	EPA 8081B	EPA 8081B	NA
Isodrin	EPA 8081B, 8270D	EPA 8081B, 8270D	NA
Methoxychlor	EPA 8081B	EPA 8081B	NA
Mirex	EPA 8081B	EPA 8081B	NA
Kepone	EPA 8270D	EPA 8270D	NA
o,o,o-Triethylphosphorothioate	EPA 8270D	EPA 8270D	NA
Parathion, ethyl	EPA 8270D	EPA 8270D	NA
Phorate	EPA 8270D	EPA 8270D	NA
Sulfotepp	EPA 8270D	EPA 8270D	NA
Thionazin (Zinophos)	EPA 8270D	EPA 8270D	NA
Dalapon	EPA 615, 8151A	EPA 8151A	NA
3,5-DCBA	EPA 615, 8151A	EPA 8151A	NA
4-Nitrophenol	EPA 615, 8151A, 625, 8270D	EPA 8270D, 8151A	NA
Dicamba	EPA 615, 8151A	EPA 8151A	NA
MCP	EPA 615, 8151A	EPA 8151A	NA
MCPA	EPA 615, 8151A	EPA 8151A	NA
Dichlorprop	EPA 615, 8151A	EPA 8151A	NA
2,4-D	EPA 615, 8151A	EPA 8151A	NA
Pentachlorophenol	EPA 615, 8151A, 625, 8270D	EPA 8151A, 8270D	NA
2,4,5-TP (Silvex)	EPA 615, 8151A	EPA 8151A	NA
Chloramben	EPA 615, 8151A	EPA 8151A	NA
2,4,5-T	EPA 615, 8151A	EPA 8151A	NA
2,4-DB	EPA 615, 8151A	EPA 8151A	NA
Bentazon	EPA 615, 8151A	EPA 8151A	NA
Picloram	EPA 615, 8151A	EPA 8151A	NA
Dinoseb	EPA 615, 8151A, 625, 8270D	EPA 8151A, 8270D	NA
Dacthal	EPA 615, EPA 8151A	EPA 8151A	NA
Acifluorfen	EPA 615, EPA 8151A	EPA 8151A	NA
2,4-DCAA	EPA 615, EPA 8151A	EPA 8151A	NA
Total coliforms	SM9222B	NA	NA
Fecal coliforms	SM9222D	NA	NA
Aluminum	EPA 200.7, 6010C	EPA 6010C	NA
Antimony	EPA 200.7, 6010C	EPA 6010C	NA
Arsenic	EPA 200.7, 6010C	EPA 6010C	NA
Barium	EPA 200.7, 6010C	EPA 6010C	NA
Beryllium	EPA 200.7, 6010C	EPA 6010C	NA
Boron	EPA 200.7, 6010C	EPA 6010C	NA
Cadmium	EPA 200.7, 6010C	EPA 6010C	NA
Calcium	EPA 200.7, 6010C	EPA 6010C	NA
Chromium	EPA 200.7, 6010C	EPA 6010C	NA
Cobalt	EPA 200.7, 6010C	EPA 6010C	NA
Copper	EPA 200.7, 6010C	EPA 6010C	NA
Hardness (calc.)	EPA 200.7, SM2340B	NA	NA
Iron	EPA 200.7, 6010C, SM18 3500-Fe D	EPA 6010C	NA
Lead	EPA 200.7, 6010C	EPA 6010C	NA

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
Lithium	EPA 200.7, 6010C	EPA 6010C	NA
Magnesium	EPA 200.7, 6010C	EPA 6010C	NA
Manganese	EPA 200.7, 6010C	EPA 6010C	NA
Molybdenum	EPA 200.7, 6010C	EPA 6010C	NA
Nickel	EPA 200.7, 6010C	EPA 6010C	NA
Potassium	EPA 200.7, 6010C	EPA 6010C	NA
Selenium	EPA 200.7, 6010C	EPA 6010C	NA
Silver	EPA 200.7, 6010C	EPA 6010C	NA
Sodium	EPA 200.7, 6010C	EPA 6010C	NA
Strontium	EPA 200.7, 6010C	EPA 6010C	NA
Thallium	EPA 200.7, 6010C	EPA 6010C	NA
Tin	EPA 200.7, 6010C	EPA 6010C	NA
Titanium	EPA 200.7, 6010C	EPA 6010C	NA
Vanadium	EPA 200.7, 6010C	EPA 6010C	NA
Zinc	EPA 200.7, 6010C	EPA 6010C	NA
Mercury	EPA 245.1, 7470	EPA 7471	NA
Sulfate	ASTM D516-90	NA	NA
Ignitability	EPA 1010	EPA 1010, EPA 1030	NA
Conductivity	EPA 120.1, SM18 2510B	NA	NA
Oil & Grease (HEM)	EPA 1664A	EPA 9071B	NA
Total Petroleum Hydrocarbons (TPH) (HEM-SGT)	EPA 1664A	NA	NA
Turbidity	EPA 180.1, SM18 2130B	NA	NA
Orthophosphate as P	EPA 365.3	NA	NA
Color	SM2120B	NA	NA
Alkalinity as CaCO <sub>3</sub>	SM2320B	NA	NA
Hardness	SM2340C	NA	NA
Residue-nonfilterable (TSS)	SM2540D	NA	NA
Residue-total	SM2540B	NA	NA
Residue-filterable (TDS)	SM2540C	NA	NA
Chromium VI	SM3500-CrD(18th/19th Ed.)/UV-VIS	NA	NA
Chloride	SM4500-Cl-C	NA	NA
Total residual chlorine	SM4500-Cl-G	NA	NA
pH	SM18 4500-H <sup>+</sup> -B, EPA 9040	EPA 9040, 9045	NA
Nitrite	SM4500-NO <sub>2</sub> B	NA	NA
Biochemical oxygen demand	SM5210B	NA	NA
Carbonaceous BOD(CBOD)	SM5210B	NA	NA
Chemical oxygen demand	SM5220D, EPA 410.4	NA	NA
Total Organic Carbon	SM18 5310B, EPA 9060	NA	NA
Total Petroleum Hydrocarbons (TPH)	FL-PRO	FL-PRO	NA
Carbon dioxide	RSK-175	NA	NA
Ethane	RSK-175	NA	NA
Ethylene	RSK-175	NA	NA
Methane	RSK-175	NA	NA
2,4,6-Trichlorophenol	EPA 625, 8270D	EPA 8270D	NA
2,4-Dichlorophenol	EPA 625, 8270D	EPA 8270D	NA
2,4-Dimethylphenol	EPA 625, 8270D	EPA 8270D	NA

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
2,4-Dinitrophenol	EPA 625, 8270D	EPA 8270D	NA
2,4-Dinitrotoluene (2,4-DNT)	EPA 625, 8270D	EPA 8270D	NA
2,6-Dinitrotoluene (2,6-DNT)	EPA 625, 8270D	EPA 8270D	NA
2-Chloronaphthalene	EPA 625, 8270D	EPA 8270D	NA
2-Chlorophenol	EPA 625, 8270D	EPA 8270D	NA
2-Methyl-4,6-dinitrophenol	EPA 625, 8270D	EPA 8270D	NA
2-Nitrophenol	EPA 625, 8270D	EPA 8270D	NA
3,3'-Dichlorobenzidine	EPA 625, 8270D	EPA 8270D	NA
4-Bromophenyl phenylether	EPA 625, 8270D	EPA 8270D	NA
4-Chloro-3-methylphenol	EPA 625, 8270D	EPA 8270D	NA
4-Chlorophenyl phenylether	EPA 625, 8270D	EPA 8270D	NA
Acenaphthene	EPA 625, 8270D	EPA 8270D	NA
Acenaphthylene	EPA 625, 8270D	EPA 8270D	NA
Aniline	EPA 625, 8270D	EPA 8270D	NA
Anthracene	EPA 625, 8270D	EPA 8270D	NA
Benzdine	EPA 625, 8270D	EPA 8270D	NA
Benzo(a)anthracene	EPA 625, 8270D	EPA 8270D	NA
Benzo(a)pyrene	EPA 625, 8270D	EPA 8270D	NA
Benzo(b)fluoranthene	EPA 625, 8270D	EPA 8270D	NA
Benzo(g,h,i)perylene	EPA 625, 8270D	EPA 8270D	NA
Benzo(k)fluoranthene	EPA 625, 8270D	EPA 8270D	NA
bis(2-Chloroethoxy)methane	EPA 625, 8270D	EPA 8270D	NA
bis(2-Chloroethyl) ether	EPA 625, 8270D	EPA 8270D	NA
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane)	EPA 625, 8270D	EPA 8270D	NA
bis(2-Ethylhexyl) phthalate(DEHP)	EPA 625, 8270D	EPA 8270D	NA
Butylbenzylphthalate	EPA 625, 8270D	EPA 8270D	NA
Chrysene	EPA 625, 8270D	EPA 8270D	NA
Dibenzo(a,h)anthracene	EPA 625, 8270D	EPA 8270D	NA
Diethyl phthalate	EPA 625, 8270D	EPA 8270D	NA
Dimethyl phthalate	EPA 625, 8270D	EPA 8270D	NA
Di-n-butyl phthalate	EPA 625, 8270D	EPA 8270D	NA
Di-n-octyl phthalate	EPA 625, 8270D	EPA 8270D	NA
Fluoranthene	EPA 625, 8270D	EPA 8270D	NA
Fluorene	EPA 625, 8270D	EPA 8270D	NA
Hexachlorobenzene	EPA 625, 8270D	EPA 8270D	NA
Hexachlorocyclopentadiene	EPA 625, 8270D	EPA 8270D	NA
Hexachloroethane	EPA 625, 8270D	EPA 8270D	NA
Indeno(1,2,3-cd)pyrene	EPA 625, 8270D	EPA 8270D	NA
Isophorone	EPA 625, 8270D	EPA 8270D	NA
Nitrobenzene	EPA 625, 8270D	EPA 8270D	NA
n-Nitrosodimethylamine	EPA 625, 8270D	EPA 8270D	NA
n-Nitrosodi-n-propylamine	EPA 625, 8270D	EPA 8270D	NA
n-Nitrosodiphenylamine	EPA 625, 8270D	EPA 8270D	NA
Phenanthrene	EPA 625, 8270D	EPA 8270D	NA
Phenol	EPA 625, 8270D	EPA 8270D	NA
Pyrene	EPA 625, 8270D	EPA 8270D	NA
Pyridine	EPA 625, 8270D	EPA 8270D	NA

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
1,1-Biphenyl	EPA 8270D	EPA 8270D	
1,2,4,5-Tetrachlorobenzene	EPA 8270D	EPA 8270D	NA
1,2-Diphenylhydrazine	EPA 8270D	EPA 8270D	NA
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D	EPA 8270D	NA
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D	EPA 8270D	NA
1,4-Naphthoquinone	EPA 8270D	EPA 8270D	NA
1,4-Phenylenediamine	EPA 8270D	EPA 8270D	NA
1-Methylnaphthalene	EPA 8270D	EPA 8270D	NA
1-Naphthylamine	EPA 8270D	EPA 8270D	NA
2,3,4,6-Tetrachlorophenol	EPA 8270D	EPA 8270D	NA
2,4,5-Trichlorophenol	EPA 8270D	EPA 8270D	NA
2,6-Dichlorophenol	EPA 8270D	EPA 8270D	NA
2-Acetylaminofluorene	EPA 8270D	EPA 8270D	NA
2-Methylnaphthalene	EPA 8270D	EPA 8270D	NA
2-Methylphenol (o-Cresol)	EPA 8270D	EPA 8270D	NA
2-Naphthylamine	EPA 8270D	EPA 8270D	NA
2-Nitroaniline	EPA 8270D	EPA 8270D	NA
2-Picoline (2-Methylpyridine)	EPA 8270D	EPA 8270D	NA
3,3'-Dimethylbenzidine	EPA 8270D	EPA 8270D	NA
3-Methylcholanthrene	EPA 8270D	EPA 8270D	NA
3-Methylphenol (m-Cresol)	EPA 8270D	EPA 8270D	NA
3-Nitroaniline	EPA 8270D	EPA 8270D	NA
4-Aminobiphenyl	EPA 8270D	EPA 8270D	NA
4-Chloroaniline	EPA 8270D	EPA 8270D	NA
4-Dimethyl aminoazobenzene	EPA 8270D	EPA 8270D	NA
4-Methylphenol (p-Cresol)	EPA 8270D	EPA 8270D	NA
4-Nitroaniline	EPA 8270D	EPA 8270D	NA
4-Nitroquinoline-n-oxide	EPA 8270D	EPA 8270D	NA
5-Nitro-o-toluidine	EPA 8270D	EPA 8270D	NA
7,12-Dimethylbenz(a)anthracene	EPA 8270D	EPA 8270D	NA
a-a-Dimethylphenethylamine	EPA 8270D	EPA 8270D	NA
Acetophenone	EPA 8270D	EPA 8270D	NA
Aramite	EPA 8270D	EPA 8270D	NA
Atrazine	EPA 8270D	EPA 8270D	NA
Benzaldehyde	EPA 8270D	EPA 8270D	NA
Benzoic acid	EPA 8270D	EPA 8270D	NA
Benzyl alcohol	EPA 8270D	EPA 8270D	NA
Caprolactam	EPA 8270D	EPA 8270D	NA
Carbazole	EPA 8270D	EPA 8270D	NA
Chlorobenzilate	EPA 8270D	EPA 8270D	NA
Cresol, Total	EPA 8270D	EPA 8270D	NA
Diallate	EPA 8270D	EPA 8270D	NA
Dibenzo(a,h)pyrene	EPA 8270D	EPA 8270D	NA
Dibenzofuran	EPA 8270D	EPA 8270D	NA
Dimethoate	EPA 8270D	EPA 8270D	NA
Diphenylamine	EPA 8270D	EPA 8270D	NA
Disulfoton	EPA 8270D	EPA 8270D	NA

*Peter N. Meyer*

Parameter/Analyte	Non-Potable Water	Solid Hazardous Waste	Air
DPH (as Azobenzene)	EPA 8270D	EPA 8270D	NA
Ethyl methanesulfonate	EPA 8270D	EPA 8270D	NA
Famphur	EPA 8270D	EPA 8270D	NA
Hexachlorophene	EPA 8270D	EPA 8270D	NA
Hexachloropropene	EPA 8270D	EPA 8270D	NA
Isosafrole	EPA 8270D	EPA 8270D	NA
Methapyrilene	EPA 8270D	EPA 8270D	NA
Methyl methane sulfonate	EPA 8270D	EPA 8270D	NA
Methyl parathion (Parathion,methyl)	EPA 8270D	EPA 8270D	NA
Nitroquinoline-1-oxide	EPA 8270D	EPA 8270D	NA
n-Nitrosodiethylamine	EPA 8270D	EPA 8270D	NA
n-Nitroso-di-n-butylamine	EPA 8270D	EPA 8270D	NA
n-Nitrosomethylethylamine	EPA 8270D	EPA 8270D	NA
n-Nitrosomorpholine	EPA 8270D	EPA 8270D	NA
n-Nitrosopiperidine	EPA 8270D	EPA 8270D	NA
n-Nitrosopyrrolidine	EPA 8270D	EPA 8270D	NA
o-Toluidine	EPA 8270D	EPA 8270D	NA
Pentachlorobenzene	EPA 8270D	EPA 8270D	NA
Pentachloroethane	EPA 8270D	EPA 8270D	NA
Pentachloronitrobenzene	EPA 8270D	EPA 8270D	NA
Phenacetin	EPA 8270D	EPA 8270D	NA
Pronamide (Kerb)	EPA 8270D	EPA 8270D	NA
Safrole	EPA 8270D	EPA 8270D	NA
C9-C18 Aliphatic Hydrocarbons	MAEPH	MAEPH	NA
C19-C36 Aliphatic Hydrocarbons	MAEPH	MAEPH	NA
C11-C22 Aromatic Hydrocarbons	MAEPH	MAEPH	NA
Diesel range organics (DRO)	EPA 8015	EPA 8015	NA
2-Methylnaphthalene	EPA 8270	EPA 8270	NA
4-Methylphenol (p-Cresol)	EPA 8270	EPA 8270	NA
Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311	EPA 1311	NA
Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312	EPA 1312	NA
Corrosivity (pH)	NA	EPA 9040	NA
Paint Filter Liquids Test	NA	EPA 9095	NA
Diethyl ether	EPA 8260	EPA 8260	NA
Ethyl methacrylate	EPA 8260	EPA 8260	NA
Iodomethane (Methyl iodide)	EPA 8260	EPA 8260	NA
Methyl Cyclohexane	EPA 8260	EPA 8260	NA
Methyl Acetate	EPA 8260	EPA 8260	NA
Isopropyl ether	EPA 8260	EPA 8260	NA

Analytical method	Prep Method			
	Soil	Water	Air	Waste
EPA 8260B	EPA 5035	EPA 5030B	NA	EPA 5035
EPA 624	NA	EPA 5030B	NA	NA
EPA 625	NA	EPA 3510C	NA	NA

*Peter M. Meyer*

Analytical method	Prep Method			
EPA 8270D	EPA 3545A	EPA 3510C	NA	EPA 3580A
EPA 200.7	NA	EPA 200.7	NA	NA
EPA 6010C	EPA 3050B	EPA 3005A	NA	EPA 3050B
EPA 608	NA	EPA 3510C	NA	NA
EPA 8081B	EPA 3545A	EPA 3510C	NA	EPA 3580A
EPA 8082A	EPA 3545A	EPA 3510C	NA	EPA 3580A
EPA 615	NA	EPA 615	NA	NA
EPA 8151A	EPA 8151A	EPA 8151	NA	EPA 8151A
MA VPH, May 2004 Revision 1.1	EPA 5035	EPA 5030B	NA	NA
MA EPH, May 2004 Revision 1.1	EPA 3545A	EPA 3510C	NA	NA
FLPRO	EPA 3545A	EPA 3510C	NA	NA
8015C – GRO	EPA 5035	EPA 5030B	NA	NA
8015C – DRO	EPA 3545A	EPA 3510C	NA	NA
TO14A	NA	NA	TO14A	NA
TO15	NA	NA	TO15	NA
SPLP	EPA 1312	EPA 1312	NA	EPA 1312
TCLP	EPA 1311	EPA 1311	NA	EPA 1311

*Peter M. Meyer*



The American Association for Laboratory Accreditation

# *Accredited DoD ELAP Laboratory*

A2LA has accredited

## **ENVIRONMENTAL CONSERVATION LABORATORIES - JACKSONVILLE**

*Jacksonville, FL*

for technical competence in the field of

### **Environmental Testing**

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 29<sup>th</sup> day of March 2010.

President & CEO  
For the Accreditation Council  
Certificate Number 3000.02  
Valid to April 30, 2012

*For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.*



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

ENVIRONMENTAL CONSERVATION LABORATORIES – ORLANDO

10775 Central Port Drive  
Orlando, FL 32824  
Lori Mangrum Phone: 407 826 5314  
lmangrum@encolabs.com

ENVIRONMENTAL

Valid To: March 31, 2012

Certificate Number: 3000.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the current DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
<u>Metals</u>	EPA 6020A/200.8	EPA 6020A
Aluminum	EPA 6020A/200.8	EPA 6020A
Antimony	EPA 6020A/200.8	EPA 6020A
Arsenic	EPA 6020A/200.8	EPA 6020A
Barium	EPA 6020A/200.8	EPA 6020A
Beryllium	EPA 6020A/200.8	EPA 6020A
Cadmium	EPA 6020A/200.8	EPA 6020A
Calcium	EPA 6020A/200.8	EPA 6020A
Chromium	EPA 6020A/200.8	EPA 6020A
Cobalt	EPA 6020A/200.8	EPA 6020A
Copper	EPA 6020A/200.8	EPA 6020A
Hardness	SM 2340 B	-----
Iron	EPA 6020A/200.8	EPA 6020A
Lead	EPA 6020A/200.8	EPA 6020A
Magnesium	EPA 6020A/200.8	EPA 6020A
Manganese	EPA 6020A/200.8	EPA 6020A
Mercury	EPA 245.1/7470A	EPA 7471B
Molybdenum	EPA 6020A/200.8	EPA 6020A
Nickel	EPA 6020A/200.8	EPA 6020A
Potassium	EPA 6020A/200.8	EPA 6020A
Selenium	EPA 6020A/200.8	EPA 6020A
Silver	EPA 6020A/200.8	EPA 6020A
Sodium	EPA 6020A/200.8	EPA 6020A
Thallium	EPA 6020A/200.8	EPA 6020A
Tin	EPA 6020A/200.8	EPA 6020A

*Peter Mangrum*

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Titanium	EPA 6020A/200.8	EPA 6020A
Vanadium	EPA 6020A/200.8	EPA 6020A
Zinc	EPA 6020A/200.8	EPA 6020A
<u>Microbiology</u>		
Total Coliforms	SM 9222B	-----
Fecal Coliforms	SM 9222D	-----
<u>General Chemistry</u>		
Acidity, as CaCO <sub>3</sub>	EPA 305.1/SM 2310 B (4A)	-----
Alkalinity as CaCO <sub>3</sub>	EPA 310.1/SM 2320 B	EPA 310.1/SM 2320 B
Alkalinity as CaCO <sub>4</sub>	EPA 310.2	EPA 310.2
Ammonia as N	-----	EPA 350.1
Biochemical oxygen demand	EPA 405.1/SM 5210 B	-----
Bromide	EPA 300.0/9056A	EPA 9056A
Carbonaceous BOD (CBOD)	SM 5210 B	-----
Chemical oxygen demand	EPA 410.4	-----
Chloride	EPA 300.0/9056A	EPA 9056A
Chromium VI	EPA 7196/ SM 3500-Cr D	EPA 7196
Conductivity	EPA 120.1	-----
Cyanide	EPA 335.2/SM 4500-CN E	EPA 9014
Ferric iron (calculated)	SM 3500-Fe D	-----
Ferrous iron	SM 3500-Fe D	-----
Fluoride	EPA 300.0/9056A	EPA 9056A
Hardness	EPA 130.2/SM 2340 C	-----
Kjeldahl nitrogen -total	EPA 351.2	EPA351.2
Nitrate as N	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrate-nitrite	EPA 300.0/353.1/9056A	EPA 353.1/9056A
Nitrite as N	EPA 300.0/354.1/9056A/SM 4500-NO <sub>2</sub> B	EPA 9056A/ SM 4500-NO <sub>2</sub> B
Organic nitrogen	EPA 351.2/350.1	EPA 351.2/350.1
Orthophosphate as P	EPA 365.1	-----
Orthophosphate as P	EPA 365.3	-----
pH	EPA 150.1/9040C/SM 4500-H <sup>+</sup> -B	EPA 9040C
Phosphorus, total	EPA 365.4	EPA 365.4
Residue-filterable (TDS)	SM 2540 C	-----
Residue-nonfilterable (TSS)	SM 2540 D	-----
Residue-total	SM 2540 B/SM 2540 G/EPA 160.3	SM 2540G/EPA 160.3
Residue-volatile	EPA 160.4	EPA 160.4
Sulfate	EPA 300.0/9056A	EPA 9056A
Sulfide	EPA 376.1/SM 4500-S E	-----
Surfactants -MBAS	SM 5540 C	-----
Total nitrate-nitrite	EPA 9056 A/SM 4500-NO <sub>3</sub> H	EPA 9056 A/SM 4500-NO <sub>3</sub> H
Total cyanide	EPA 9014	EPA 9014
Total nitrogen	TKN + Total nitrate-nitrite	TKN + Total nitrate-nitrite
Total Organic Carbon	EPA 9060A/SM 5310B	TOC Walkley Black
Total phenolics	EPA 420.1	EPA 420.1
Total, fixed, and volatile residue	SM 2540 G	SM 2540 G
Turbidity	EPA 180.1	-----
Un-ionized ammonia	DEP SOP 10/03/83	DEP SOP 10/03/83
<u>Extractable Organics</u>		

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
1,2,4-Trichlorobenzene	EPA 8270D/625	EPA 8270D
1,2,4,5-Tetrachlorobenzene	EPA 8270D/625	EPA 8270D
1,2-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1,2-Diphenylhydrazine	EPA 8270D/625	EPA 8270D
1,3-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1,4-Dichlorobenzene	EPA 8270D/625	EPA 8270D
1-Methylnaphthalene	EPA 8270D/625/ Scan-Sim	EPA 8270D/ Scan-Sim
2,3,4,6-Tetrachlorophenol	EPA 8270D/625	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D/625	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D/625	EPA 8270D
2,4-Dichlorophenol	EPA 8270D/625	EPA 8270D
2,4-Dimethylphenol	EPA 8270D/625	EPA 8270D
2,4-Dinitrophenol	EPA 8270D/625	EPA 8270D
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D/625/ Scan-Sim	EPA 8270D
2,6-Dichlorophenon	EPA 8270D/625	EPA 8270D
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D/625	EPA 8270D
2-Chloronaphthalene	EPA 8270D/625	EPA 8270D
2-Chlorophenol	EPA 8270D/625	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D/625	EPA 8270D
2-Methylnaphthalene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
2-Methylphenol (o-Cresol)	EPA 8270D/625	EPA 8270D
2-Nitroaniline	EPA 8270D/625	EPA 8270D
2-Nitrophenol	EPA 8270D/625	EPA 8270D
3,3'-Dichlorobenzidine	EPA 8270D/625	EPA 8270D
3/4-Methylphenols (m/p-Cresols)	EPA 8270D/625	EPA 8270D
3-Nitroaniline	EPA 8270D/625	EPA 8270D
4-Bromophenyl phenyl ether	EPA 8270D/625	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D/625	EPA 8270D
4-Chloroaniline	EPA 8270D/625	EPA 8270D
4-Chlorophenyl phenyl ether	EPA 8270D/625	EPA 8270D
4-Nitrophenol	EPA 8270D/625	EPA 8270D
Acenaphthene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Acenaphthylene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
4-Methylphenol (p-Cresol)	EPA 8270D/625	EPA 8270D
4-Nitroaniline	EPA 8270D/625	EPA 8270D
Acetophenone	EPA 8270D/625	EPA 8270D
Anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan Sim
Atrazine	EPA 8270D/625	EPA 8270D
Benzaldehyde	EPA 8270D/625	EPA 8270D
Benzidine	EPA 8270D/625/ Scan-Sim	EPA 8270D
Benzo(a)anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(a)pyrene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(b)fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(g,h,i)perylene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzo(k)fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Benzyl alcohol	EPA 8270D/625	EPA 8270D
1,1-Biphenyl	EPA 8270D/625	EPA 8270D
bis(2-Chloroethoxy) methane	EPA 8270D/625	EPA 8270D
bis(2-Chloroethyl) ether	EPA 8270D/625	EPA 8270D
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270D/625	EPA 8270D

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270D/625	EPA 8270D
Butyl benzyl phthalate	EPA 8270D/625	EPA 8270D
Caprolactam	EPA 8270D/625	EPA 8270D
Carbazole	EPA 8270D/625	EPA 8270D
Chrysene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Dibenz(a,h)anthracene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Dibenzofuran	EPA 8270D/625	EPA 8270D
Diethyl phthalate	EPA 8270D/625	EPA 8270D
Dimethyl phthalate	EPA 8270D/625/ Scan-Sim	EPA 8270D
Di-n-butyl phthalate	EPA 8270D/625	EPA 8270D
Di-n-octyl phthalate	EPA 8270D/625	EPA 8270D
Fluoranthene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Fluorene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Hexachlorobenzene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Hexachlorobutadiene	EPA 8270D/625/ Scan-Sim	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D/625	EPA 8270D
Hexachloroethane	EPA 8270D/625	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D/625/ Scan-Sim	EPA 8270D Scan-Sim
Isodrin	EPA 8270D/625	EPA 8270D
Isophorone	EPA 8270D/625	EPA 8270D
Naphthalene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Nitrobenzene	EPA 8270D/625	EPA 8270D
n-Nitrosodimethylamine	EPA 8270D/625	EPA 8270D
n-Nitrosodi-n-propylamine	EPA 8270D/625	EPA 8270D
n-Nitrosodiphenylamine	EPA 8270D/625	EPA 8270D
n-Nitrosopyrrolidine	EPA 8270D/625	EPA 8270D
Pentachlorophenol	EPA 8270D/625/ Scan-Sim	EPA 8270D
Phenanthrene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Phenol	EPA 8270D/625	EPA 8270D
Pyrene	EPA 8270D/625 Scan-Sim	EPA 8270D Scan-Sim
Total Petroleum Hydrocarbons (TPH)	FL-PRO	FL-PRO
<u>Volatile Organics</u>		
1,1,1,2-Tetrachloroethane	EPA 8260B/624	EPA 8260B
1,1,1-Trichloroethane	EPA 8260B/624	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 8260B/624	EPA 8260B
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B/624	EPA 8260B
1,1,2-Trichloroethane	EPA 8260B/624	EPA 8260B
1,1-Dichloroethane	EPA 8260B/624	EPA 8260B
1,1-Dichloroethene	EPA 8260B/624	EPA 8260B
1,1-Dichloropropene	EPA 8260B/624	EPA 8260B
1,2,3-Trichlorobenzene	EPA 504.1/8260B/624	EPA 8260B
1,2,3-Trichloropropane	EPA 8260B/624	EPA 8260B
1,2,4-Trichlorobenzene	EPA 8260B/624	EPA 8260B
1,2,4-Trimethylbenzene	EPA 8260B/624	EPA 8260B
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504 /504.1/8011/8260B	EPA 8260B
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504 /504.1/8011/8260B	EPA 8260B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
1,2-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,2-Dichloroethane	EPA 8260B/624	EPA 8260B
1,2-Dichloropropane	EPA 8260B/624	EPA 8260B
1,3,5-Trimethylbenzene	EPA 8260B/624	EPA 8260B
1,3-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,3-Dichloropropane	EPA 8260B/624	EPA 8260B
1,4-Dichlorobenzene	EPA 8260B/624	EPA 8260B
1,4-Dioxane (1,4-Diethylenecoxide)	EPA 8260B/8260C SIM/624	EPA 8260B/8260C SIM
2,2-Dichloropropane	EPA 8260B/624	EPA 8260B
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B/624	EPA 8260B
2-Chloroethyl vinyl ether	EPA 8260B/624	EPA 8260B
2-Chlorotoluene	EPA 8260B/624	EPA 8260B
2-Hexanone	EPA 8260B/624	EPA 8260B
4-Chlorotoluene	EPA 8260B/624	EPA 8260B
4-Methyl-2-pentanone (MIBK)	EPA 8260B/624	EPA 8260B
Acetone	EPA 8260B/624	EPA 8260B
Acetonitrile	EPA 8260B/624	EPA 8260B
Acrolein (Propenal)	EPA 8260B/624	EPA 8260B
Acrylonitrile	EPA 8260B/624	EPA 8260B
Allyl chloride (3-Chloropropene)	EPA 8260B/624	EPA 8260B
Benzene	EPA 8260B/624	EPA 8260B
Bromobenzene	EPA 8260B/624	EPA 8260B
Bromochloromethane	EPA 8260B/624	EPA 8260B
Bromodichloromethane	EPA 8260B/624	EPA 8260B
Bromoform	EPA 8260B/624	EPA 8260B
Carbon tetrachloride	EPA 8260B/624	EPA 8260B
Carbon disulfide	EPA 8260B/624	EPA 8260B
Chlorobenzene	EPA 8260B/624	EPA 8260B
Chloroethane	EPA 8260B/624	EPA 8260B
Chloroform	EPA 8260B/624	EPA 8260B
Chloroprene	EPA 8260B/624	EPA 8260B
cis-1,2-Dichloroethene	EPA 8260B/624	EPA 8260B
cis-1,3-Dichloropropene	EPA 8260B/624	EPA 8260B
Cyclohexane	EPA 8260B/624	EPA 8260B
Dibromochloromethane	EPA 8260B/624	EPA 8260B
Dibromomethane	EPA 8260B/624	EPA 8260B
Dichlorodifluoromethane	EPA 8260B/624	EPA 8260B
Ethyl methacrylate	EPA 8260B/624	EPA 8260B
Hexachlorobutadiene	EPA 8260B/624	EPA 8260B
Ethylbenzene	EPA 8260B/624	EPA 8260B
Iodomethane (Methyl iodide)	EPA 8260B/624	EPA 8260B
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260B/624	EPA 8260B
Isopropylbenzene	EPA 8260B/624	EPA 8260B
m+p-Xylenes	EPA 8260B/624	EPA 8260B
Methacrylonitrile	EPA 8260B/624	EPA 8260B
Methyl acetate	EPA 8260B/624	EPA 8260B
Methyl bromide (Bromomethane)	EPA 8260B/624	EPA 8260B
Methyl chloride (Chloromethane)	EPA 8260B/624	EPA 8260B
Methyl methacrylate	EPA 8260B/624	EPA 8260B
Methyl tert-butyl ether (MTBE)	EPA 8260B/624	EPA 8260B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Methylcyclohexane	EPA 8260B/624	EPA 8260B
Methylene chloride	EPA 8260B/624	EPA 8260B
Naphthalene	EPA 8260B/624	EPA 8260B
n-Butylbenzene	EPA 8260B/624	EPA 8260B
n-Propylbenzene	EPA 8260B/624	EPA 8260B
o-Xylene	EPA 8260B/624	EPA 8260B
Pentachloroethane	EPA 8260B/624	EPA 8260B
p-Isopropyltoluene	EPA 8260B/624	EPA 8260B
Propionitrile (Ethyl cyanide)	EPA 8260B/624	EPA 8260B
sec-Butylbenzene	EPA 8260B/624	EPA 8260B
Styrene	EPA 8260B/624	EPA 8260B
tert-Butylbenzene	EPA 8260B/624	EPA 8260B
Tetrachloroethene (Perchloroethylene)	EPA 8260B/624	EPA 8260B
Toluene	EPA 8260B/624	EPA 8260B
trans-1,2-Dichloroethene	EPA 8260B/624	EPA 8260B
trans-1,3-Dichloropropene	EPA 8260B/624	EPA 8260B
trans-1,4-Dichloro-2-butene	EPA 8260B/624	EPA 8260B
Trichloroethene (Trichloroethylene)	EPA 8260B/624	EPA 8260B
Trichlorofluoromethane	EPA 8260B/624	EPA 8260B
Vinyl acetate	EPA 8260B/624	EPA 8260B
Vinyl chloride	EPA 8260B/624	EPA 8260B
Xylene (total)	EPA 8260B/624	EPA 8260B
<b><u>Pesticides-Herbicides-PCBs</u></b>		
2,4,5-T	EPA 8151A /615	EPA 8151A
2,4-D	EPA 8151A /615	EPA 8151A
2,4-DB	EPA 8151A /615	EPA 8151A
3,5-Dichlorobenzoic acid	EPA 8151A /615	EPA 8151A
4,4'-DDD	EPA 8081B/608	EPA 8081B
4,4'-DDE	EPA 8081B/608	EPA 8081B
4,4'-DDT	EPA 8081B/608	EPA 8081B
4-Nitrophenol	EPA 8151A/615	EPA 8151A
Acifluorfen	EPA 8151A/615	EPA 8151A
Aldrin	EPA 8081B/608	EPA 8081B
alpha-BHC (alpha- Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
alpha-Chlordane	EPA 8081B/608	EPA 8081B
Aroclor-1016(PCB-1016)	EPA 8082A/608	EPA 8082A
Aroclor-1221 (PCB-1221)	EPA 8082A/608	EPA 8082A
Aroclor-1232 (PCB-1232)	EPA 8082A/608	EPA 8082A
Aroclor-1242 (PCB-1242)	EPA 8082A/608	EPA 8082A
Aroclor-1248 (PCB-1248)	EPA 8082A/608	EPA 8082A
Aroclor-1254 (PCB-1254)	EPA 8082A/608	EPA 8082A
Aroclor-1260 (PCB-1260)	EPA 8082A/608	EPA 8082A
Aroclor-1262 (PCB-1262)	EPA 8082A/608	EPA 8082A
Aroclor-1268 (PCB-1268)	EPA 8082A/608	EPA 8082A
Azinphos-methyl (Guthion)	EPA 8141B/614	EPA 8141B
Bentazon	EPA 8151A/615	EPA 8151A
beta-BHC (beta- Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
Bolstar (Sulprofos)	EPA 8141B/614	EPA 8141B

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Chloramben	EPA 8151A/615	EPA 8151A
Chlordane (tech.)	EPA 8081B/608	EPA 8081B
Chlorpyrifos	EPA 8141B/614	EPA 8141B
Coumaphos	EPA 8141B/614	EPA 8141B
Dacthal (DCPA)	EPA 8151A/615	EPA 8151A
Dalapon	EPA 8151A/615	EPA 8151A
delta-BHC	EPA 8081B/608	EPA 8081B
Demeton-o	EPA 8141B/614	EPA 8141B
Demeton-s	EPA 8141B/614	EPA 8141B
Diazinon	EPA 8141B/614	EPA 8141B
Dicamba	EPA 8151A/615	EPA 8151A
Dichlorofenthion	EPA 8141B/614	EPA 8141B
Dichloroprop (Dichlorprop)	EPA 8151A/615	EPA 8151A
Dichlorovos (DDVP, Dichtovos)	EPA 8141B/614	EPA 8141B
Dieldrin	EPA 8081B/608	EPA 8081B
Dimethoate	EPA 8141B/614	EPA 8141B
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNB P)	EPA 8151A/615	EPA 8151A
Disulfoton	EPA 8141B/614	EPA 8141B
Endosulfan I	EPA 8081B/608	EPA 8081B
Endosulfan II	EPA 8081B/608	EPA 8081B
Endosulfan sulfate	EPA 8081B/608	EPA 8081B
Endrin	EPA 8081B/608	EPA 8081B
Endrin aldehyde	EPA 8081B/608	EPA 8081B
Endrin ketone	EPA 8081B/608	EPA 8081B
EPN	EPA 8141B/614	EPA 8141B
Ethion	EPA 8141B/614	EPA 8141B
Ethoprop	EPA 8141B/614	EPA 8141B
fensulfothion	EPA 8141B/614	EPA 8141B
fenthion	EPA 8141B/614	EPA 8141B
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081B/608	EPA 8081B
gamma-Chlordane	EPA 8081B/608	EPA 8081B
Heptachlor	EPA 8081B/608	EPA 8081B
Heptachlor epoxide	EPA 8081B/608	EPA 8081B
Isodrin	EPA 8081B/608	EPA 8081B
Malathion	EPA 8141B/614	EPA 8141B
MCPA	EPA 8151A/615	EPA 8151A
MCPP	EPA 8151A/615	EPA 8151A
Merphos	EPA 8141B/614	EPA 8141B
Methoxychlor	EPA 8081B/608	EPA 8081B
Methyl parathion (Parathion, methyl)	EPA 8141B/614	EPA 8141B
Mevinphos	EPA 8141B/614	EPA 8141B
Mirex	EPA 8081B/608	EPA 8081B
Monocrotophos	EPA 8141B/614	EPA 8141B
Naled	EPA 8141B/614	EPA 8141B
Parathion, ethyl	EPA 8141B/614	EPA 8141B
Pentachlorophenol	EPA 8151A/615	EPA 8151A
Phorate	EPA 8141B/614	EPA 8141B
Picloram	EPA 8151A/615	EPA 8151A
Ronnel	EPA 8141B/614	EPA 8141B
Silvex (2A.5-TP)	EPA 8151B/615	EPA 8151B

*Peter M. Meyer*

Analyte / Parameter	Non-Potable Water	Solid Hazardous Waste
Stirofos	EPA 8141B/614	EPA 8141B
Sulfotepp	EPA 8141B/614	EPA 8141B
Tetraethyl pyrophosphate (TEPP)	EPA 8141B/614	EPA 8141B
Tokuthion (Prothiophos)	EPA 8141B/614	EPA 8141B
Toxaphene (Chlorinated camphene)	EPA 8081B/608	EPA 8081B
Trichloronate	EPA 8141B/614	EPA 8141B

#### Preparation Methods

Fraction	Analytical Method	Preparation Method
Cyanide	EPA 9014 EPA 335.2 /SM 4500-CN E	EPA 9010C
TX	EPA 9056A	EPA 5050
Metal water prep	EPA 6020A/200.8	EPA 3005A
Metals soil prep	EPA 6020A	EPA 3050B
Metals TCLP prep	EPA 6020A/200.8	EPA 3010A
Extractable organics and Pesticides water prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3510C
Extractable organics and Pesticides waste prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3580A
Extractable organics and Pesticides soil prep	EPA 8270D/625/8081B/8082A/ 608/ 8141B/ 614	EPA 3550C
Organics water and mid-level soil prep	EPA 8260B/624	EPA 5030B
Organics low-level soil prep	EPA 8260B/624	EPA 5035
Soil/water leachate	Wets	ENCO WETS-88
SPLP	Wets, Organics, and Metals	EPA 1312
TCLP	Wets, Organics, and Metals	EPA 1311



World Class Accreditation

The American Association for Laboratory Accreditation

# *Accredited DoD ELAP Laboratory*

A2LA has accredited

## **ENVIRONMENTAL CONSERVATION LABORATORIES - ORLANDO**

*Orlando, FL*

for technical competence in the field of

### **Environmental Testing**

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 29<sup>th</sup> day of March 2010.

President & CEO  
For the Accreditation Council  
Certificate Number 3000.01  
Valid to March 31, 2012

*For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.*

**Appendix C**  
**Health and Safety Plan**

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# **NSF Indian Head Site 47 Predesign Investigation including Baseline and Short-Term Groundwater Monitoring**

Prepared for  
**Naval Facilities Engineering Command, Washington**

Washington, D.C.

February 2012



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## ATTACHMENTS

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- Attachment 2 Chemical Inventory/Register Form
- Attachment 3 Chemical-Specific Training Form
- Attachment 4 Project Activity Self-Assessment Checklists/Forms/Permits
- Attachment 5 Key Target Zero Program Elements
- Attachment 6 Fact Sheets
- Attachment 7 Observed Hazard Form
- Attachment 8 Stop Work Order Form
- Attachment 9 Agency Inspection Target Zero Bulletin
- Attachment 10 Completed CH2M HILL AHAs
- Attachment 11 Material Safety Data Sheets

# Approval

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This site-specific Health and Safety Plan (HSP) has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions and identified scope(s) of work and must be amended if those conditions or scope(s) of work change.

By approving this HSP, the Responsible Health and Safety Manager (RHSM) certifies that the personal protective equipment has been selected based on the project-specific hazard assessment.

## Original Plan

**RHSM Approval:** Mark Orman

**Date:** 7 February 2012

---

**Project Manager Approval:**

**Date:**

---

## Revisions

**Revisions Made By:**

**Date:**

**Description of Revisions to Plan:**

**Revisions Approved By:**

**Date:**

---

# 1 Introduction

CH2MHILL

HSSE  
Target Zero  
World Class Performance



## Health, Safety, Security and Environment Policy

Protection of people and the environment is a CH2M HILL core value. It is our vision to create a culture within CH2M HILL that empowers employees to drive this value into all global operations and achieve excellence in health, safety, security and environment (HSSE) performance. CH2M HILL deploys an integrated, enterprise-wide behavior based HSSE management system to fulfill our mission and the expectations of our clients, staff, and communities based on the following principles:

- We require all management and supervisory personnel to provide the leadership and resources to inspire and empower our employees to take responsibility for their actions of their fellow employees to create a safety, healthy, secure and environmentally-responsible workplace.
- We provide value to clients by tailoring HSSE processes to customer needs and requiring all CH2M HILL employees and subcontractors to deliver projects with agility, personal service, and responsiveness and in compliance with HSSE requirements and company standards to achieve health, safety, and security and pollution prevention excellence. Our performance will aspire to influence others and continually redefine world-class HSSE excellence.
- We systematically evaluate our design engineering and physical work environment to verify safe and secure work conditions and practices are established, consistently followed, and timely corrected.
- We continually assess and improve our HSSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely reviewing our program.
- We care about the safety and security of every CH2M HILL employee and expect all employees to embrace our culture, share our core value for the protection of people and the environment, understand their obligations, actively participate, take responsibility, and "walk the talk" on and off the job.

The undersigned pledge our leadership, commitment, and accountability for making this policy a reality at CH2M HILL.

Dated the 29th date of March, 2011.

Lee McIntire  
Chief Executive Officer

John Madia  
Chief Human Resources Officer

Mike Lucki  
Chief Financial Officer

Margaret McLean  
Chief Legal Officer

Mike McKelvy  
President, Government, Environment,  
& Nuclear Division

Bob Card  
President, Energy & Water Division

Jacqueline Rast  
President, Facilities & Infrastructure Division

Fred Brune  
President, International Division

Gene Lupis  
President, Delivery Excellence

Keith Christopher  
Senior Vice President, Health, Safety,  
Security and Environment

## **1.1 CH2M HILL Policy and Commitment**

### **1.1.1 Safe Work Policy**

It is the policy of CH2M HILL to perform work in the safest manner possible. Safety must never be compromised. To fulfill the requirements of this policy, an organized and effective safety program must be carried out at each location where work is performed.

CH2M HILL believes that all injuries are preventable, and we are dedicated to the goal of a safe work environment. To achieve this goal, every employee on the project must assume responsibility for safety.

Every employee is empowered to:

- Conduct their work in a safe manner;
- Stop work immediately to correct any unsafe condition that is encountered; and
- Take corrective actions so that work may proceed in a safe manner.

Safety, occupational health, and environmental protection will not be sacrificed for production. These elements are integrated into quality control, cost reduction, and job performance, and are crucial to our success.

### **1.1.2 Health and Safety Commitment**

CH2M HILL has embraced a philosophy for health and safety excellence. The primary driving force behind this commitment to health and safety is simple: employees are CH2M HILL's most significant asset and CH2M HILL management values their safety, health, and welfare. Also, top management believes that all injuries are preventable. CH2M HILL's safety culture empowers employees at all levels to accept ownership for safety and take whatever actions are necessary to eliminate injury. Our company is committed to world-class performance in health and safety and also understands that world-class performance in health and safety is a critical element in overall business success.

CH2M HILL is committed to the prevention of personal injuries, occupational illnesses, and damage to equipment and property in all of its operations; to the protection of the general public whenever it comes in contact with the Company's work; and to the prevention of pollution and environmental degradation.

Company management, field supervisors, and employees plan safety into each work task in order to prevent occupational injuries and illnesses. The ultimate success of CH2M HILL's safety program depends on the full cooperation and participation of each employee.

CH2M HILL management extends its full commitment to health and safety excellence.

### **1.1.3 Project-Specific Health, Safety, and the Environment Goals**

All management and employees are to strive to meet the project-specific Health, Safety, and the Environment (HSE) goals outlined below. The team will be successful only if everyone makes a concerted effort to accomplish these goals. The goals allow the project to stay focused on optimizing the health and safety of all project personnel and, therefore, making the project a great success.

The Project has established eleven specific goals and objectives:

- Create an injury-free environment;
- Have zero injuries or incidents;
- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example;
- Ensure effective implementation of the HSP through education, delegation, and team work;
- Ensure 100 percent participation in HSE compliance;

- Continuously improve our safety performance;
- Maintain free and open lines of communication;
- Make a personal commitment to safety as a value;
- Focus safety improvements on high-risk groups;
- Continue strong employee involvement initiatives; and
- Achieve health and safety excellence.

## 2 Applicability

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This HSP applies to:

- All CH2M HILL staff, including subcontractors and tiered subcontractors of CH2M HILL working on the site; and
- All visitors to the construction site in the custody of CH2M HILL (including visitors from the Client, the Government, the public, and other staff of any CH2M HILL company).

This HSP does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of CH2M HILL.

This HSP defines the procedures and requirements for the health and safety of CH2M HILL staff and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This HSP will be kept onsite during field activities and will be reviewed as necessary. The HSP will be amended or revised as project activities or conditions change or when supplemental information becomes available. The HSP adopts, by reference, the Enterprise-wide Core Standards and Standard Operating Procedures (SOPs), as appropriate. In addition, the HSP may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this HSP and any governing regulation, the more stringent and protective requirement shall apply.

All CH2M HILL staff and subcontractors must sign the employee sign-off form included in this document as Attachment 1 to acknowledge review of this document. Copies of the signature page will be maintained onsite by the Safety Coordinator (SC).

## 3 General Project Information

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### 3.1 Project Information and Background

**Project Number:** 424770.MS.MS.WP

**Client:** NAVFAC

**Project/Site Name:** Site 47 Naval Support Facility, Indian Head (NSF-IH)

**Site Address:** Indian Head, Maryland

**CH2M HILL Project Manager:** Margaret Kasim/WDC

**CH2M HILL Office:** Chantilly, VA

**DATE HSP Prepared:** February 2012

**Date(s) of Site Work:** April 2012

### 3.2 Site Background and Setting

(Mercuric Nitrate Disposal Area) is in the northwest central part of the area. Mercuric nitrate was used in Building 856 as a catalyst in the production of the missile propellant hydrazinium nitroformate and was disposed of at a location near the southeast corner of the building. The disposal area consisted of about 24 square feet (4 feet by 6 feet) near the drainage ditch that begins near the southeast corner of the building. The disposal site was covered with limestone chips to provide neutralization for the spent catalyst disposed of at the site. There is no evidence of the disposal area at present.

Information provided by NSF-IH indicated that carbon tetrachloride was used as a solvent in one of the processes in Building 856.

Drainage in the ditch adjoining the former disposal location flows generally southward to another ditch, which drains to the southeast toward Mattawoman Creek. The creek is located about one-half mile southeast of Site 47 and flows eastward into the Potomac River. The Potomac River is located only about 800 feet northwest of the site.

Several concrete troughs are located on the north side of Building 856. At one time the troughs were lined with lead sheeting and carried process solutions from Building 856 to storage and treatment in Building 856A. The troughs are still present but the lead sheeting has been removed.

An industrial wastewater sewer is located in the vicinity of Building 856. A manhole (designated IW91) is located about 50 feet west of the building.

See Site Map for work area.

### 3.3 Description of Tasks

All CH2M HILL and Subcontractor employees engaging in hazardous waste operations (HAZWOPER) or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65 (or if required by Subcontract). Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities. See the following tasks that fall under HAZWOPER requirements.

### 3.3.1 HAZWOPER-Regulated Tasks

- Utility Clearance
- Air knifing for utility clearance
- MIP direct push drilling and sampling
- Direct push soil and groundwater sampling
- Monitoring well installation by HSA
- Groundwater sampling

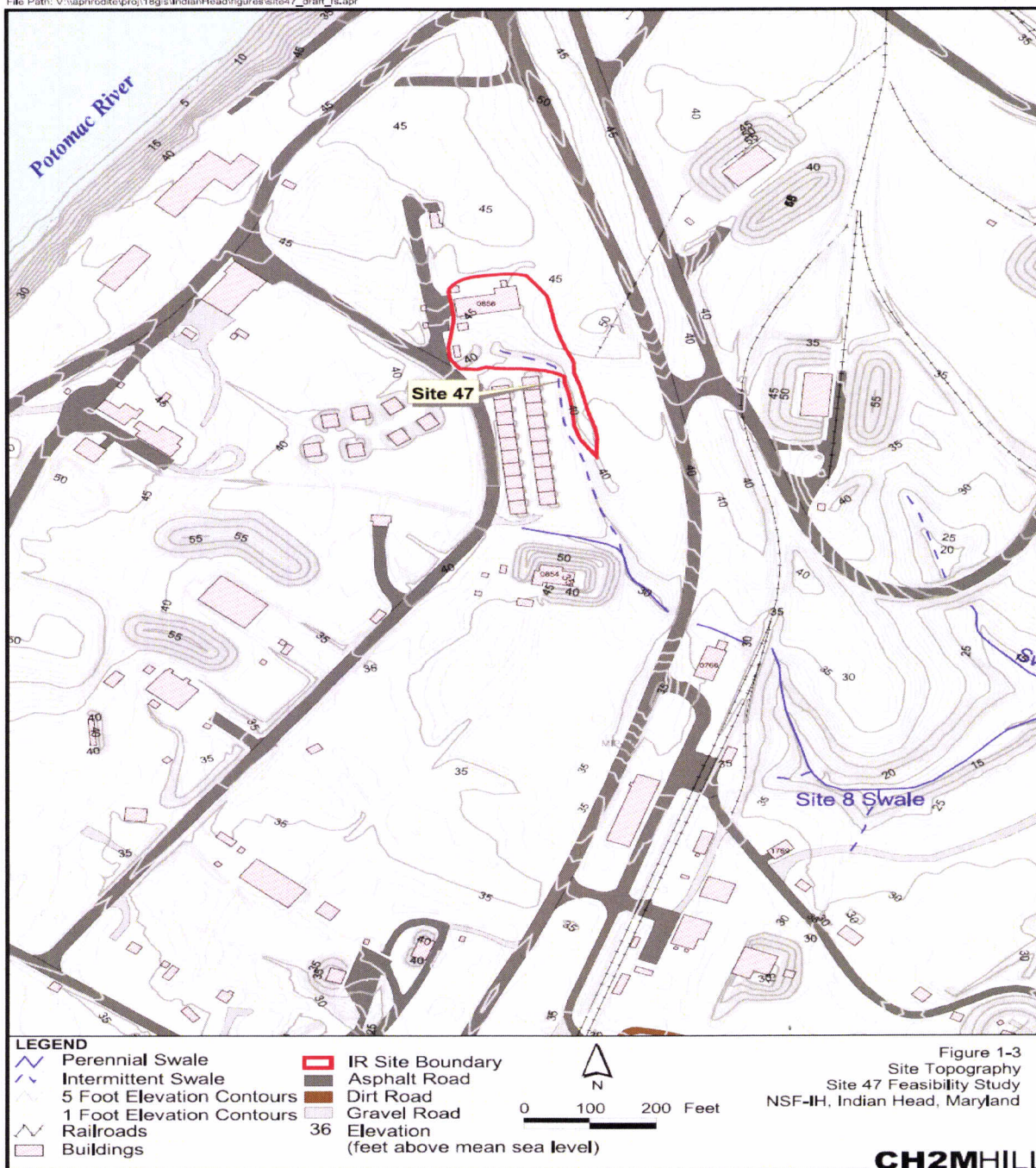
### 3.3.2 Non-HAZWOPER-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. The following tasks do not involve exposure to safety or health hazards associated with the hazardous waste operations. Hazwoper training or medical requirements do not apply for the tasks listed below.

TASKS	CONTROLS
<ul style="list-style-type: none"><li>• Surveying of installed monitoring wells</li><li>• IDW transport</li></ul>	<ul style="list-style-type: none"><li>• Brief on hazards, limits of access, and emergency procedures.</li><li>• Post areas of contamination as appropriate.</li><li>• Perform air sampling/monitoring as specified in this HSP.</li></ul>

## 3.4 Site Map

File Path: V:\aphrodite\proj\18gis\IndianHead\figures\site47\_draft\_fs.apr



## 4 Project Organization and Responsibilities

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### 4.1 Client

Contact Name: NAVFAC RPM Joe Rail, P.E.

Phone: 202-685-3105/3279

Facility Contact Name: Nick Carros

Phone: 301-744-2263

### 4.2 CH2M HILL

#### 4.2.1 Project Manager

PM Name: Margaret Kasim

CH2M HILL Office: WDC

Telephone Number: 703/376-5154

Cellular Number: ?

The project manager (PM) is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HSE management process. The PM has overall management responsibility for the tasks listed below. The PM may explicitly delegate specific tasks to other staff, as described in sections that follow, but retains ultimate responsibility for completion of the following in accordance with this document:

- Incorporate standard terms and conditions, and contract-specific HSE roles and responsibilities in contract and subcontract agreements (including flow-down requirements to lower-tier subcontractors).
- Select safe and competent subcontractors by:
  - Choosing potential subcontractors based on technical ability and HSE performance;
  - Implementing the subcontractor prequalification process;
  - Ensuring that acceptable certificates of insurance, including CH2M HILL as named additional insured, are secured as a condition of subcontract award; and
  - Ensuring HSE submittals, subcontract agreements, and appropriate site-specific safety procedures are in place and accepted prior field mobilization.
- Ensure copies of training and medical monitoring records, and site-specific safety procedures are being maintained in the project file accessible to site personnel.
- Provide oversight of subcontractor HSE practices per the site-specific safety plans and procedures.
- Manage the site and interfacing with 3<sup>rd</sup> parties in a manner consistent with the contract and subcontract agreements and the applicable standard of reasonable care.
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented.
- Provide visible support and motivation for HSE programs, rules, procedures, processes, and training, leading by example and encouraging CH2M HILL employees to take ownership of HSE issues.
- Intervene or stop work when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition is encountered.
- Make available to and require CH2M HILL employees to complete required HSE training within established timelines and provide project numbers for such training.
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites.

- Promptly report all work-related HSE incidents or near misses.
- Wear any required personal protective equipment.
- Ensure CH2M HILL employees complete required HSE training within established timelines.
- Conduct, cooperate, or assist with HSE incident investigations.
- Consult with the Human Resources Delivery Partner before taking any disciplinary action (other than verbal counseling) associated with CH2M HILL Policy 203 and/or HSE programs rules, procedures, processes and training.

#### **4.2.2 CH2M HILL Responsible Health and Safety Manager**

RHSM Name: Mark Orman

CH2M HILL Office: MKE

Telephone Number: 414/847-0597

Cellular Number: 414/712-4138

The RHSM is responsible for the following:

- Review and evaluate subcontractor HSE performance using the pre-qualification process;
- Approve HSP and its revisions as well as Activity Hazard Analyses (AHA);
- Review and evaluate subcontractor site-specific safety procedures for adequacy prior to start of subcontractor's field operations;
- Support the oversight (or SC's direct oversight) of subcontractor and tiered subcontractor HSE practices;
- Permit upgrades and downgrades in respiratory protection after reviewing analytical data;
- Conduct audits as determined by project schedule and coordination with PM; and
- Participate in incident investigations, lessons learned, loss and near loss reporting.

#### **4.2.3 CH2M HILL Project Environmental Manager**

EM Name: Hope Wilson

CH2M HILL Office: ATL

Telephone Number: 678-530-4226

Cellular Number: 678-656-5411

The Project EM is responsible for the following:

- Provide environmental program support in areas such as training, auditing, planning, permit tracking, and subcontractor oversight as needed or as specified in the project environmental plan;
- Review and evaluate qualifications for subcontractors with a history of environmental non-compliance and for waste transportation and disposal subcontractors;
- Evaluate any spills, releases, or environmental permit incidents for appropriate follow-up actions, notifications, and recordkeeping requirements; and
- Provide environmental compliance and environmental management expertise and advice to the project team as needed during the course of the project.

#### 4.2.4 CH2M HILL Safety Coordinator

SC Name: TBD

CH2M HILL Office:

Telephone Number:

Cellular Number:

The SC is responsible for verifying that the project is conducted in a safe manner including the following specific obligations:

- Verify this HSP is current and amended when project activities or conditions change;
- Verify CH2M HILL site personnel and subcontractor personnel read the HSP and sign the Employee Sign-Off Form, prior to commencing field activities;
- Verify CH2M HILL site personnel have completed any required specialty training (for example, fall protection, confined space entry, among others) and medical surveillance as identified in this HSP;
- Verify that project files include copies of subcontractor training and medical monitoring records, and accepted site-specific safety procedures prior to start of subcontractor's field operations;
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in the HSP;
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in the HSP;
- Post the Occupational Safety and Health Administration (OSHA) job-site poster; the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established. If you work in a state with an OSHA State Plan, make sure the State Plan poster is posted, if required;
- Hold and/or verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (as tasks or hazards change);
- Verify that project health and safety forms and permits are being used as outlined this HSP;
- Perform oversight and assessments of subcontractor HSE practices per the site-specific safety plan and verify that project activity self-assessment checklists are being used as outlined this HSP;
- Coordinate with the RHSM regarding CH2M HILL and subcontractor operational performance, and 3<sup>rd</sup> party interfaces;
- Verify appropriate personal protective equipment (PPE) use, availability, and training;
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented;
- Conduct accident investigations including root cause analysis;
- Calibrate and conduct air monitoring in accordance with the HSP; maintain all air monitoring records in project file;
- Maintain HSE records and documentation;
- Facilitate OSHA or other government agency inspections including accompanying inspector and providing all necessary documentation and follow-up;
- Deliver field HSE training as needed based on project-specific hazards and activities;
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites;
- Wear any required personal protective equipment;
- Conduct, cooperate, or assist with HSE incident investigations;

- Contact the PM and RHSM when standards of conduct or CH2M HILL Policy 203 has been violated by a CH2M HILL employee;
- Contact the RHSM and PM in the event of an incident;
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, stop affected work until adequate corrective measures are implemented, and notify the PM and RHSM as appropriate; and
- Document all oral health and safety-related communications in project field logbook, daily reports, or other records.

## 4.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HSE-215, *Contracts and Subcontracts*)

Subcontractor: Air knife

Subcontractor Contact Name: TBD

Telephone:

Subcontractor: Utility clearance

Subcontractor Contact Name: TBD

Telephone:

Subcontractor: MIP

Subcontractor Contact Name: TBD

Telephone:

Subcontractor: DPT drilling

Subcontractor Contact Name: TBD

Telephone:

Subcontractor: MW installation by hollow stem auger

Subcontractor Contact Name: TBD

Telephone:

Subcontractor: Surveying of monitoring wells

Subcontractor Contact Name: TBD

Telephone:

Subcontractor: IDW transportation and disposal.

Subcontractor Contact Name: TBD

Telephone:

Subcontractors must comply with the following activities, and are responsible to:

- Comply with all local, state, and federal safety standards;
- Comply with project and owner safety requirements;
- Actively participate in the project safety program and either hold or attend and participate in all required safety meetings;
- Provide a qualified safety representative to interface with CH2M HILL;
- Maintain safety equipment and PPE for their employees;
- Maintain and replace safety protection systems damaged or removed by the subcontractor's operations;

- Notify the SC of any accident, injury, or incident (including spills or releases) immediately and submit reports to CH2M HILL within 24 hours;
- Install contractually required general conditions for safety (for example, handrail, fencing, fall protection systems, floor opening covers);
- Conduct and document weekly safety inspections of project-specific tasks and associated work areas;
- Conduct site-specific and job-specific training for all subcontractor employees, including review of the CH2M HILL HSP, subcontractor HSPs, and subcontractor AHAs and sign appropriate sign-off forms; and
- Determine and implement necessary controls and corrective actions to correct unsafe conditions.

The subcontractors listed above may be required to submit their own site-specific HSP and other plans such as lead or asbestos abatement compliance plans. Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit their plans to CH2M HILL for review and acceptance before the start of field work.

Subcontractors are also required to prepare AHAs before beginning each activity posing hazards to their personnel. The AHA shall identify the principle steps of the activity, potential health and safety hazards for each step and recommended control measures for each identified hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements, and training requirements for the safe operation of the equipment listed must be identified.

## 4.4 Employee Responsibilities

All personnel are assigned responsibility for safe and healthy operations. This concept is the foundation for involving all employees in identifying hazards and providing solutions. For any operation, individuals have full authority to stop work and initiate immediate corrective action or control. In addition, each worker has a right and responsibility to report unsafe conditions or practices. This right represents a significant facet of worker empowerment and program ownership. Through shared values and a belief that all accidents are preventable, our employees accept personal responsibility for working safely.

Each employee is responsible for the following performance objectives:

- Understanding and abiding by CH2M HILL and client HSE programs, rules, procedures, processes, and training, including any that are project-specific;
- Completing all required HSE training made available and accessible within established timelines;
- Always wearing any required personal protective equipment;
- Intervening or stopping work for you or other CH2M HILL employees when an unsafe condition or behavior is encountered or observed, and/or when an environmentally compromising condition exists;
- Promptly notifying a supervisor, PM, SC, or RHSM when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition exists;
- Promptly reporting a supervisor, PM, SC, or RHSM all work-related health, safety, and environmental incidents or near misses;
- Attending required project HSE pre-task briefings and meeting prior to performing work; and
- Cooperating or assisting with HSE incident investigations.

### 4.4.1 Employee Authority

Each employee on the project has the obligation and authority to shut down any perceived unsafe work and during employee orientation, each employee will be informed of their authority to do so.

## 4.5 Client Contractors

(Reference CH2M HILL SOP HSE-215, *Contracts, Subcontracts and HSE Management Practices*)

Contractor: **None**

Contact Name:

Telephone:

Contractor Task(s):

This HSP does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (such as advising on health and safety issues). In addition to these instructions, CH2M HILL team members should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Self-assessment checklists are to be used by the SC and CH2M HILL team members to review the contractor's performance only as it pertains to evaluating CH2M HILL exposure and safety. The RHSM is the only person who is authorized to comment on or approve contractor safety procedures.

Health and safety-related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL team members on the precautions related to the contractor's work;
- When an apparent contractor non-compliance or unsafe condition or practice poses a risk to CH2M HILL team members:
  - Notify the contractor safety representative;
  - Request that the contractor determine and implement corrective actions;
  - If necessary, stop affected CH2M HILL work until contractor corrects the condition or practice; and
  - Notify the client, PM, and RHSM as appropriate.

If apparent contractor non-compliance or unsafe conditions or practices are observed, inform the contractor safety representative (CH2M HILL's obligation is limited strictly to informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative (CH2M HILL's obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

All verbal health and safety-related communications will be documented in project field logbook, daily reports, or other records.

## 5 Standards of Conduct

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All individuals associated with this project must work injury-free and drug-free and must comply with the following standards of conduct, the HSP, and the safety requirements of CH2M HILL. Commonly accepted standards of conduct help maintain good relationships between people. They promote responsibility and self-development. Misunderstandings, frictions, and disciplinary action can be avoided by refraining from thoughtless or wrongful acts.

### 5.1 Standards of Conduct Violations

All individuals associated with this project are expected to behave in a professional manner. Violations of the standards of conduct would include, but not be limited to:

- Failure to perform work;
- Inefficient performance, incompetence, or neglect of work;
- Willful refusal to perform work as directed (insubordination);
- Negligence in observing safety regulations, poor housekeeping, or failure to report on-the-job injuries or unsafe conditions;
- Unexcused or excessive absence or tardiness;
- Unwillingness or inability to work in harmony with others;
- Discourtesy, irritation, friction, or other conduct that creates disharmony;
- Harassment or discrimination against another individual;
- Failure to be prepared for work by wearing the appropriate construction clothing or bringing the necessary tools; or
- Violation of any other commonly accepted reasonable rule of responsible personal conduct.

### 5.2 Disciplinary Actions

The Environmental Services (ES) business group employees, employees working on ES business group projects, and subcontractor employees are subject to disciplinary action for not following HSE rules and requirements. Potential disciplinary action is equally applicable to all employees including management and supervision. Disciplinary action may include denial of access to the worksite, warnings, reprimands, and other actions up to and including termination depending on the specific circumstances.

### 5.3 Subcontractor Safety Performance

CH2M HILL should continuously endeavor to observe subcontractors' safety performance and adherence to their plans and AHAs. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. CH2M HILL oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

### **5.3.1 Observed Hazard Form**

When apparent non-compliance or unsafe conditions or practices are observed, notify the subcontractor's supervisor or safety representative verbally, and document using the Observed Hazard Form, included as an attachment to this HSP, and require corrective action.

If necessary, stop subcontractor's work using the Stop Work Order Form until corrective actions is implemented for observed serious hazards or conditions. Update the Observed Hazard Form to document corrective actions have been taken. The subcontractor is responsible for determining and implementing necessary controls and corrective actions.

### **5.3.2 Stop Work Order**

CH2M HILL has the authority, as specified in the contract, and the responsibility to stop work in the event any CH2M HILL employee observes unsafe conditions or failure of the subcontractor to adhere to its safe-work practices, or observes a condition or practice that may result in a release or violation of an environmental requirement. This authority and action does not in any way relieve the subcontractor of its responsibilities for the means and methods of the work or, therefore, of any corrective actions. Failure to comply with safe work practices can be the basis for restriction or removal of the subcontractor staff from the job site, termination of the subcontract, restriction from future work, or all three.

When an apparent imminent danger is observed, immediately stop work and alert all affected individuals. Remove all affected CH2M HILL employees and subcontractor staff from the danger, notify the subcontractor's supervisor or safety representative, and do not allow work to resume until adequate corrective measures are implemented. Notify the PM, Contract Administrator (KA) and RHSM.

When repeated non-compliance or unsafe conditions are observed, notify the subcontractor's supervisor or safety representative and stop affected work by completing and delivering the Stop Work Order Form (attached to this HSP) until adequate corrective measures are implemented. Consult the KA to determine what the contract dictates for actions to pursue in event of subcontractor non-compliance including work stoppage, back charges, progress payments, removal of subcontractor manager, monetary penalties, or termination of subcontractor for cause.

## **5.4 Incentive Program**

Each project is encouraged to implement a safety incentive program that rewards workers for exhibiting exemplary safety behaviors. Actions that qualify are those that go above and beyond what is expected. Actions that will be rewarded include spotting and correcting a hazard, bringing a hazard to the attention of your foreman, telling your foreman about an incident, coming up with a safer way to get the work done, or stopping a crew member from doing something unsafe. The program will operate throughout the project, covering all workers. The incentive program will be communicated to all employees during the project employee orientation and project safety meetings.

## **5.5 Reporting Unsafe Conditions/Practices**

Responsibility for effective health and safety management extends to all levels of the project and requires good communication between employees, supervisors, and management. Accident prevention requires a pro-active policy on near misses, close calls, unsafe conditions, and unsafe practices. All personnel must report any situation, practice, or condition which might jeopardize the safety of our projects. All unsafe

conditions or unsafe practices will be corrected immediately. CH2M HILL has zero tolerance of unsafe conditions or unsafe practices.

No employee or supervisor will be disciplined for reporting unsafe conditions or practices. Individuals involved in reporting the unsafe conditions or practices will remain anonymous.

The following reporting procedures will be followed by all project employees:

- Upon detection of any unsafe condition or practice, the responsible employee will attempt to safely correct the condition;
- The unsafe condition or practice will be brought to the attention of the worker's direct supervisor, unless the unsafe condition or practice involves the employee's direct supervisor. If so, the SC needs to be notified at once by the responsible employee;
- Either the responsible employee or responsible employee's direct supervisor is responsible for immediately reporting the unsafe condition or practice to the SC;
- The SC will act promptly to correct the unsafe condition or practice; and
- Details of the incident or situation will be recorded by the SC in the field logbook or use the Observed Hazard Form if subcontractor was involved.

## 6 Safety Planning and Change Management

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### 6.1 Daily Safety Meetings and Pre-Task Safety Plans

Daily safety meetings are to be held with all project personnel in attendance to review the hazards posed and required HSE procedures and AHAs that apply for each day's project activities. The Pre-Task Safety Plans (PTSPs) serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews.

At the start of each day's activities, the crew supervisor completes the PTSP, provided as an attachment to this HSP, with input from the work crew, during their daily safety meeting. The day's tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required HSE procedures, as identified in the HSP and AHA. The use of PTSPs promotes worker participation in the hazard recognition and control process while reinforcing the task-specific hazard and required HSE procedures with the crew each day.

### 6.2 Change Management

This HSP addresses all known activities and associated hazards. As work progresses, if significant changes are identified which could affect health and safety at the site, coordinate with the RHSM to determine whether a HSP update is necessary.

The following are examples of changes that may require a revision to the plan:

- Change in CH2M HILL staff;
- New subcontractor to perform work;
- New chemicals brought to site for use;
- Change in scope or addition of new tasks;
- Change in contaminants of concern (COCs) or change in concentrations of COCs; and
- New hazards or hazards not previously identified that are not addressed in this HSP.

### 6.3 Agency Inspection Guidance

(Reference CH2M HILL SOP HSE-201, *Agency Inspections and Communications*)

Agency inspections (e.g., OSHA, EPA, other regulatory agencies) are on the rise. CH2M HILL implements safety and environmental programs in order to ensure safety to workers, the public, and the environment. This plan addresses things like labeling containers, completing the hazard communication training using the attachments to this HSP, listing training requirements and PPE requirements, and addressing project-specific hazards. Field personnel need to contact the RHSM to update this plan if hazards are encountered that are not addressed.

[SOP HSE-201](#) addresses agency inspections in detail, and the attached **Target Zero Bulletin on Agency Inspections** provides a good summary of the inspection process and what to do if an agency such as OSHA or EPA shows up at the site. It is critical to make immediate notification to the RHSM if an inspector arrives (and EM if it is environmental-related); they can help facilitate and make additional notifications.

Review the Target Zero Bulletin and keep it with your Health and Safety Plan/Environmental Plan. Make it a topic at a safety meeting and keep it readily available in the event of an inspection.

## 7 Project Hazard Analysis

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A health and safety risk analysis (Table 1) has been performed for each task. In the order listed below, the RHSM considers the various methods for mitigating the hazards. Employees are trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects:

- Elimination of the hazards (use remote sampling methodology to avoid going into a confined space);
- Substitution (reduce exposure to vapors by using of a geoprobe instead of test pitting);
- Engineering controls (ventilate a confined space to improve air quality);
- Warnings (establish exclusion zones to keep untrained people away from hazardous waste work);
- Administrative controls (implement a work-rest schedule to reduce chance of heat stress); or
- Use of PPE (use of respirators when action levels are exceeded).

The hazard controls and safe work practices are summarized in the following sections of this HSP:

- General hazards and controls;
- Project-specific hazards and controls;
- Physical hazards and controls;
- Biological hazards and controls; and
- Contaminants of concern.

### 7.1 Activity Hazard Analysis

An AHA must be developed for each CH2M HILL job activity. The AHA shall define the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements to be performed and training requirements for the safe operation of the equipment listed must be identified. Workers are briefed on the AHA before performing the work and their input is solicited prior, during, and after the performance of work to further identify the hazards posed and control measures required. The AHA shall identify the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard.

The following hazard controls and applicable CH2M HILL core standards and SOPs should be used as a basis for preparing AHAs.

AHAs prepared for CH2M HILL activities are included as an attachment to this HSP.

### 7.2 Subcontractor Activity Hazard Analysis

CH2M HILL subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by CH2M HILL. Each subcontractor shall submit AHAs for their field activities, as defined in their scope of work, along with their project-specific safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

TABLE 1  
General Activity Hazard Analysis

Potential Hazard	Air Knifing	Utility clearance	MIP sampling	DPT soil and GW sampling	MW installation by HSA	Surveying of new MWs	IDW transport	GW monitoring
Arsenic	X	X	X	X	X			X
Biological Hazards	X	X	X	X	X	X		X
Chemical Hazards	X		X	X	X			X
Drilling			X	X	X			
Drum Handling	X			X	X		X	X
Drum Sampling							X	
Electrical Safety	X		X	X	X			X
Field Vehicles	X	X	X	X	X	X	X	X
Fire Prevention	X				X			
Groundwater Sampling				X				X
Hand & Power Tools	X	X	X	X	X	X	X	X
Knife Use					X			
Manual Lifting	X		X	X	X	X	X	X
Noise	X			X	X			
Pressure Washing	X			X	X			
Temperature Extremes	X	X	X	X	X	X	X	X
Ultraviolet Light exposure (sunburn)	X	X	X	X	X	X	X	X
Utilities (underground/overhead)	X	X	X	X	X			

## 8 General Hazards and Controls

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This section provides safe work practices and control measures used to reduce or eliminate potential hazards. It is a summarized list of requirements. Always consult the appropriate CH2M HILL SOP to ensure all requirements are implemented.

### 8.1 Bloodborne Pathogens

(Reference CH2M HILL SOP HSE-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or cardiopulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material (PIM).

Employees trained in first-aid/CPR or those exposed to PIM must complete CH2M HILL's 1-hour bloodborne pathogens computer-based training module annually. When performing first-aid/CPR the following shall apply:

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials;
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes; and
- If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.

CH2M HILL will provide exposed employees with a confidential medical examination should an exposure to PIM occur. This examination includes the following procedures:

- Documenting the exposure;
- Testing the exposed employee's and the source individual's blood (with consent); and
- Administering post-exposure prophylaxis.

### 8.2 Chemical Storage

The following are general guidelines for storing chemicals and other hazardous materials:

- Keep acids away from bases;
- Keep oxidizers (nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (metals);
- Keep flammables and corrosives in appropriate storage cabinets;
- Do not store paper or other combustibles near flammables;
- Use secondary containment and lipped shelving that is secured; and
- Have a fire suppression system available.

#### 8.2.1 Storage of Flammable/Combustible Liquids

- Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.

- Approved safety cans shall be used for the handling and use of flammable liquids in quantities of 5 gallons (19 liters) or less. Do not use plastic gas cans.
- For quantities of 1 gallon (3.78 liters) or less, the original container may be used for storage and use of flammable liquids.
- Flammable or combustible liquids shall not be stored in areas used for stairways or normally used for the passage of people.

### 8.2.2 Indoor Storage of Flammable/Combustible Liquids

- No more than 25 gallons (95 liters) of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet.
- Quantities of flammable and combustible liquids in excess of 25 gallons (95 liters) shall be stored in an acceptable or approved cabinet.
- Cabinets shall be conspicuously lettered: "FLAMMABLE: KEEP FIRE AWAY."
- Not more than 60 gallons (228 liters) of flammable or 120 gallons (456 liters) of combustible liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area.

### 8.2.3 Outside Storage of Flammable/Combustible Liquids

- Storage of containers (not more than 60 gallons [228 liters] each) shall not exceed 1,100 gallons (4180 liters) in any one area. No area shall be within 20 feet (6.1 meters) of any building.
- Storage areas shall be graded to divert spills away from buildings and surrounded by an earthen dike.
- Storage areas may not be located near a storm drain. Overflow and spills must be diverted away from storm drains or surface waters.
- Storage areas shall be free from weeds, debris, and other combustible materials.
- Outdoor portable tanks shall be provided with emergency vent devices and shall not be closer than 20 feet (6.1 meters) to any building.
- Signs indicating no smoking shall be posted around the storage area.

### 8.2.4 Storage of Hazardous Waste

- All facilities storing ignitable and combustible liquids and hazardous wastes must be designed, constructed, maintained, and operated to minimize the possibility of a fire, explosion, or any release of hazardous constituents.
- Flammable wastes should be stored more than 50 feet from the property line.

### 8.2.5 Storage of Chemical Injection Chemicals/Materials

When chemical injection remediation technologies are being used at a site, the following storage guidelines must be followed:

- Some injection chemicals, such as strong oxidizers, may have stringent storage requirements per local or National Fire Codes. Verify that appropriate storage provisions are in place prior to starting work.

**NOTE:** Counties and cities may have requirements specific to storing these chemicals. Also, storage and use of certain chemicals such as potassium permanganate and hydrogen peroxide may be subject to the new Chemical Facility Anti-Terrorism Standards of the Department of Homeland Security – the applicability depends on the chemical, quantity/concentration, and type of facility. Please contact the project Environmental Manager to determine whether chemicals are subject to these standards.

- Injection chemicals must be stored in a designated, secured area with spill prevention capabilities. Review MSDS or other information to determine potential incompatible materials. Incompatible materials shall not be stored together. Ensure all containers are labeled.

## 8.3 Driving Safety

Follow the guidelines below when operating a vehicle:

- Refrain from using a cellular phone while driving. Pull off the road, put the vehicle in park and turn on flashers before talking on a cellular phone;
- Never operate a personal digital assistant (PDA), or other device with e-mail, internet, or text messaging function while driving a vehicle;
- Obey speed limits; be aware of blind spots or other hazards associated with low visibility. Practice defensive driving techniques, such as leaving plenty of room between your vehicle and the one ahead of you;
- Do no drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep;
- Maintain focus on driving. Eating, drinking, smoking, adjusting controls can divert attention from the road. Take the time to park and perform these tasks when parked rather than while driving; and
- Ensure vehicle drivers are familiar with the safe operation of vehicles of the type and size to be operated. Large vehicles such as full size vans and pick-ups have different vision challenges and handling characteristics than smaller vehicles.

## 8.4 Electrical Safety

(Reference CH2M HILL SOP HSE-206, *Electrical Safety*)

Below are the hazard controls and safe work practices to follow when using electrical tools, extension cords, and/or other electrical-powered equipment or when exposed to electrical hazards. Ensure the requirements of the referenced SOP are followed:

- Only qualified personnel are permitted to work on unprotected energized electrical systems;
- Only authorized personnel are permitted to enter high-voltage areas;
- CH2M HILL employees who might from time to time work in an environment influenced by the presence of electrical energy must complete Awareness Level Electrical Safety Training located on the CH2M HILL Virtual Office;
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented;
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service;
- CH2M HILL has selected Ground Fault Circuit Interrupters (GFCIs) as the standard method for protecting employees from the hazards associated with electric shock;
  - GFCIs shall be used on all 120-volt, single phase 15 and 20-ampere receptacle outlets which are not part of the permanent wiring of the building or structure.
- An assured equipment grounding conductor program may be required under the following scenarios:
  - GFCIs cannot be utilized;
  - Client requires such a program to be implemented; or
  - Business group decides to implement program in addition to GFCI protection.

- Extension cords must be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated or protected from damage. Cords should not be routed through doorways unless protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire;
- Electrical power tools and equipment must be effectively grounded or double-insulated and Underwriters Laboratory (UL) approved;
- Operate and maintain electric power tools and equipment according to manufacturers' instructions;
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inches (1.0 cm) for every 1 kV over 50 kV;
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage; and
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

## 8.5 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles, or project vehicles.
- Maintain a first aid kit, bloodborne pathogen kit, and fire extinguisher in the field vehicle at all times.
- Utilize a rotary beacon on vehicle if working adjacent to active roadway.
- Familiarize yourself with rental vehicle features prior to operating the vehicle:
  - Vision Fields and Blind Spots
  - Vehicle Size
  - Mirror adjustments
  - Seat adjustments
  - Cruise control features, if offered
  - Pre-program radio stations and Global Positioning System (GPS), if equipped
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van or pick-up truck.
- Close car doors slowly and carefully. Fingers can get pinched in doors.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.
- Ensure back-up alarms are functioning, if equipped. Before backing a vehicle, take a walk around the vehicle to identify obstructions or hazards. Use a spotter when necessary to back into or out of an area.
- See the Vehicle Accident Guidance attached to this HSP, if a vehicle incident is experienced in a rental or fleet vehicle.

## 8.6 Fire Prevention

(Reference CH2M HILL SOP HSE-403, *Hazardous Material Handling*)

Follow the fire prevention and control procedures listed below.

### 8.6.1 Fire Extinguishers and General Fire Prevention Practices

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet (30.5 meters). When 5 gallons (19 liters) or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet (15.2 meters). Extinguishers must:
  - be maintained in a fully charged and operable condition;
  - be visually inspected each month; and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet (3 meters) from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Keep areas neat. Housekeeping is important.

### 8.6.2 Dispensing of Flammable/Combustible Liquids

- Areas in which flammable or combustible liquids are dispensed in quantities greater than 5 gallons (22.7 liters) shall be separated from other operations by at least 25 feet (7.6 meters).
- Drainage away from storm drains or surface waters or other means of containment shall be provided to control spills.
- Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.
- Dispensing of flammable liquids from one container to another shall be done only when containers are electrically interconnected (bonded).
- Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks is prohibited.
- Dispensing devices and nozzles for flammable liquids shall be of an approved type.

## 8.7 General Practices and Housekeeping

The following are general requirements applicable to all portions of the work:

- Site work should be performed during daylight hours whenever possible;
- Good housekeeping must be maintained at all times in all project work areas;
- Common paths of travel should be established and kept free from the accumulation of materials;
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions;
- Provide slip-resistant surfaces, ropes, or other devices to be used;
- Specific areas should be designated for the proper storage of materials;
- Tools, equipment, materials, and supplies shall be stored in an orderly manner;
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area;
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals;
- All spills shall be quickly cleaned up; oil and grease shall be cleaned from walking and working surfaces;

- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others;
- Familiarize yourself with, understand, and follow jobsite emergency procedures;
- Do not fight or horseplay while conducting the firm's business;
- Do not use or possess firearms or other weapons while conducting the firm's business;
- Report unsafe conditions or unsafe acts to your supervisor immediately;
- Report emergencies, occupational illnesses, injuries, vehicle accidents, and near misses immediately;
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment;
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor;
- Shut down and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion;
- Do not run in the workplace;
- When ascending or descending stairways, use the handrail and take one step at a time;
- Do not apply compressed air to any person or clothing;
- Do not wear steel taps or shoes with metal exposed to the sole at any CH2M HILL project location;
- Do not wear finger rings, loose clothing, wristwatches, and other loose accessories when within arm's reach of moving machinery;
- Remove waste and debris from the workplace and dispose of in accordance with federal, state, and local regulations;
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible; and
- Check the work area to determine what problems or hazards may exist.

## 8.8 Hazard Communication

(Reference CH2M HILL SOPs HSE-107, *Hazard Communication* and HSE-403, *Hazardous Material Handling*)

The hazard communication coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using the chemical inventory form included as an attachment to this HSP;
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available;
- Request or confirm locations of material safety data sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed;
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical and include on the chemical inventory sheet (attached to this HSP) and add the MSDS to the MSDS attachment section of this HSP;
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly;
- Give employees required chemical-specific HAZCOM training using the chemical-specific training form included as an attachment to this HSP; and
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

## 8.9 Knife Use

Open-bladed knives (for example, box cutters, utility knives, pocket knives, machetes, and multi-purpose tools with fixed blades such as a Leatherman™) are prohibited at worksites except where the following three conditions are met:

- The open-bladed knife is determined to be the best tool for the job;
- An approved Activity Hazard Analysis (AHA) or written procedure is in place that covers the necessary safety precautions (work practices, PPE, and training); and
- Knife users have been trained and follow the AHA.

## 8.10 Lighting

Lighting shall be evaluated when conducting work inside buildings, confined spaces, or other areas/instances where supplemental light may be needed (e.g., work before sunrise or after sunset). A light meter can be used to evaluate the adequacy of lighting. The following are common requirements for lighting and the conditions/type of work being performed:

- While work is in progress outside construction areas shall have at least 33 lux (lx);
- Construction work conducted inside buildings should be provided with at least 55 lux light;
- The means of egress shall be illuminated with emergency and non-emergency lighting to provide a minimum 11 lx measured at the floor. Egress illumination shall be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb will not leave any area in total darkness.

## 8.11 Manual Lifting

(Reference CH2M HILL SOP HSE-112, *Manual Lifting*)

Back injuries are the leading cause of disabling work and most back injuries are the result of improper lifting techniques or overexertion. Use the following to mitigate the hazards associated with lifting:

- When possible, the task should be modified to minimize manual lifting hazards;
- Lifting of loads weighing more than 40 pounds (18 kilograms) shall be evaluated by the SC using the Lifting Evaluation Form contained in SOP HSE-112;
- Using mechanical lifting devices is the preferred means of lifting heavy objects such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys;
- Personnel shall seek assistance when performing manual lifting tasks that appear beyond their physical capabilities;
- In general, the following steps must be practiced when planning and performing manual lifts: Assess the situation before you lift; ensure good lifting and body positioning practices; ensure good carrying and setting down practices; and
- All CH2M HILL workers must have training in proper manual lifting training either through the New Employee Orientation or through Manual Lifting module located on the VO.

## 8.12 Personal Hygiene

Good hygiene is essential for personal health and to reduce the potential of cross-contamination when working on a hazardous waste site. Implement the following:

- Keep hands away from nose, mouth, and eyes during work;

- Keep areas of broken skin (chapped, burned, etc.) covered; and
- Wash hands with soap and water prior to eating, smoking, or applying cosmetics.

## 8.13 Shipping and Transportation of Hazardous Materials

(Reference CH2M HILL SOP HSE-417, *Hazardous Materials Transportation*)

The U.S. Department of Transportation (DOT) has specific regulations governing shipping of hazardous materials (also called dangerous goods). Chemicals brought to the site might be defined as hazardous materials by the U.S. DOT. Hazardous wastes that may be shipped offsite are also defined as hazardous materials by U.S. DOT. Other wastes may also be U.S. DOT hazardous materials. To confirm whether a material or a waste is a U.S. DOT hazardous material, check with the ESBG Waste Coordinator (Lisa Schwan/ATL), the project EM, or the CH2M HILL Dangerous Goods Shipping Coordinators (John Blasco/BAO or Rob Strehlow/MKW).

All staff who affect shipment of hazardous materials, including receiving hazardous materials, preparing profiles or manifests, packaging hazardous wastes, labeling, or transporting hazardous materials by road, are called HazMat employees (note CH2M HILL cannot transport hazardous wastes by public road). HazMat employees must receive CH2M HILL online training in shipping dangerous goods. CH2M HILL's online Dangerous Goods Shipping course can be found on the CH2M HILL HSSE website.

All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. If the material is a product that is being shipped (e.g., calibration gas), use the HazMat ShipRight tool on the CH2M HILL virtual office (under Company Resources – Online Shipping). Contact the Dangerous Goods Shipping coordinators, the ESBG Waste Coordinator or the project EM for additional information.

49 CFR 172 requires that all hazmat employees be aware of potential transportation security concerns. Hazardous materials security is addressed in CH2M HILL's Hazardous Materials SOP (HSE-403). The following points are provided as an overview of security measures to increase awareness of this important matter:

- It is essential that each employee understand the security risks involved with transporting hazardous materials;
- All transporters of hazardous materials must be prequalified by a Contracts Administrator who evaluate the carrier's safety rating, security measures, and employee screening procedures;
- When shipping hazardous materials, check driver credentials and ask about shipping details;
- When receiving a hazardous materials shipment, inspect packages for signs of tampering or damage to the contents. Verify the drivers and company information on the form with the driver; and
- If there is suspicious or unusual behavior (e.g., driver without credentials, evasive answers) or any discrepancies identified, do not offer or accept the shipment, and immediately notify the project manager or the RHSM.

Employees responsible for shipping hazard materials must also review the CH2M HILL Transportation Security Plan (HSE-417 Appendix A).

## 8.14 Substance Abuse

(Reference CH2M HILL SOP HSE-105, *Drug-Free Workplace*)

Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. CH2M HILL does not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior.

Prohibitions onsite include:

- Use or possession of intoxicating beverages while performing CH2M HILL work;
- Abuse of prescription or nonprescription drugs;
- Use or possession of illegal drugs or drugs obtained illegally;
- Sale, purchase, or transfer of legal, illegal or illegally obtained drugs; and
- Arrival at work under the influence of legal or illegal drugs or alcohol.

Drug and/or alcohol testing is applicable under CH2M HILL Constructors, Inc. and munitions response projects performed in the United States. In addition, employees may be required to submit to drug and/or alcohol testing as required by clients. When required, this testing is performed in accordance with SOP HSE-105, Drug-Free Workplace. Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the CH2M HILL Virtual Office (VO).

## 9 Project-Specific Hazard Controls

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This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the work or the particular hazard. Each person onsite is required to abide by the hazard controls. Always consult the appropriate CH2M HILL SOP to ensure all requirements are implemented. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

### 9.1 Arsenic

(Reference CH2M HILL, SOP HSE-501, *Arsenic*)

Based on previous sampling data, SOW and engineering controls the following is provided for information purposed in the event of a change in conditions. Unless conditions change, PPE will be sufficient to control arsenic. Arsenic is considered a "Confirmed Human Carcinogen." CH2M HILL is required to control employee exposure to arsenic when exposures are at or above 5.0 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ), or if there is the possibility of skin or eye irritation from arsenic. The elements of the CH2M HILL arsenic program include the following:

- Exposure monitoring;
- Methods of control, including PPE and respirators;
- Medical surveillance;
- Training on hazards of arsenic and control measures (includes project-specific training and the computer-based training on CH2M HILL's Virtual Office, *Arsenic Exposure*); and
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Full implantation of SOP HSE-501, Arsenic, will be required. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to this HSP.

### 9.2 Drilling Safety

(Reference CH2M HILL SOP HSE-204, *Drilling*)

Below are the hazard controls and safe work practices to follow when working around or performing drilling. Ensure the requirements in the referenced SOP are followed.

- The drill rig is not to be operated in inclement weather.
- The driller is to verify that the rig is properly leveled and stabilized before raising the mast.

- Personnel should be cleared from the sides and rear of the rig before the mast is raised.
- The driller is not to drive the rig with the mast in the raised position.
- The driller must check for overhead power lines before raising the mast. Maintain a minimum distance of 10 feet (3 meters) between mast and overhead lines (<50 kV) and an additional 0.4 inches for every 1 kV over 50kV. Verify the voltage of nearby overhead power lines to determine the minimum distance.
- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include unexploded ordnance (UXO), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. "Down-hole" avoidance support may be required to prevent accidental contact with UXO. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
- Personnel should stand clear before rig startup.
- The driller is to verify that the rig is in neutral when the operator is not at the controls.
- Become familiar with the hazards associated with the drilling method used (cable tool, air rotary, hollow-stem auger, etc.).
- Do not wear loose-fitting clothing, watches, etc., that could get caught in moving parts.
- Do not smoke or permit other spark-producing equipment around the drill rig.
- The drill rig must be equipped with a kill wire or switch, and personnel are to be informed of its location.
- Be aware and stand clear of heavy objects that are hoisted overhead.
- The driller is to verify that the rig is properly maintained in accordance with the drilling company's maintenance program.
- The driller is to verify that all machine guards are in place while the rig is in operation.
- The driller is responsible for housekeeping (maintaining a clean work area).
- The drill rig should be equipped with at least one fire extinguisher.
- If the drill rig comes into contact with electrical wires and becomes electrically energized, do not touch any part of the rig or any person in contact with the rig, and stay as far away as possible. Notify emergency personnel immediately.
- Use the drilling self-assessment checklist attached to this HSP to evaluate drilling operations.

### 9.3 Drum and Portable Tank Handling

Below are the hazard controls and safe work practices to follow when overseeing the movement of drums or when handling drums:

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries;
- Ensure drum or tank bungs and lids are secured and are labeled prior to moving;
- Ensure that drums and tanks remain covered except when removing or adding material or waste. Covers and/or lids will be properly secured at the end of each workday;
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; Roller conveyor equipped with solid rollers; drum carts designed specifically for drum handling;

- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface;
- Ensure there are appropriately designed Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials;
- Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency;
- Supply operators with appropriate respiratory protective equipment when needed;
- Ensure that drums are secure and are not in the operator's view of the roadway;
- Prior to handling, all personnel should be warned about hazards of handling;
- Before moving anything, determine the most appropriate sequence in which the various drums, portable tanks, and other containers should be moved (e.g. small containers may have to be removed first to permit heavy equipment to enter and move the drums);
- Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur;
- Use containers or overpacks that are compatible with the waste or materials;
- Drums containing liquids or hazardous waste will be provided with secondary containment and may not be located near a storm water inlet or conveyance;
- Allow enough aisle space between drum pallets and between drums and other equipment that the drums can be easily accessed (at least 2 to 3 feet) by fire control equipment and similar equipment.; and
- Make sure that a spill kit is available in drum or tank storage areas (or where liquids are transferred from one vessel to another).

## 9.4 Drum Sampling Safety

Personnel are permitted to handle and/or sample drums containing certain types of waste (drilling waste, investigation-derived waste, and waste from known sources) only. Handling or sampling drums with unknown contents requires a plan revision or amendment approved by the RHSM. The following control measures will be taken when sampling drums:

- Minimize transportation of drums;
- Sample only labeled drums or drums from a known waste stream;
- Do not sample bulging or swollen drums. Contact the RHSM;
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open;
- Use the proper tools to open and seal drums;
- Reseal bung holes or plugs whenever possible;
- Avoid mixing incompatible drum contents;
- Sample drums without leaning over the drum opening;
- Transfer/sample the content of drums using a method that minimizes contact with material;
- Use the PPE and perform air monitoring as specified in the PPE and Site Monitoring sections of this HSP;
- Take precautions to prevent contaminated media from contacting the floor or ground, such as having plastic under the sampling area, having a spill kit accessible during sampling activities; and

- If transferring/sampling drums containing flammable or combustible liquids, drums and liquid transfer equipment should be grounded and bonded to reduce the potential of a static discharge.

## 9.5 Groundwater Sampling/Water Level Measurements

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are performing groundwater sampling and/or water level measurements.

- Full coolers are heavy. Plan in advance to have two people available at the end of the sampling effort to load full coolers into vehicles. If two people won't be available use several smaller coolers instead of fewer large ones.
- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (see PPE section of this HSP).
- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to the "Site Monitoring" section of this HSP).
- Use caution when opening well lids. Wells may contain poisonous spiders and hornet or wasp nests.
- Use the appropriate lifting procedures (see CH2M HILL SOP HSE-112) when unloading equipment and sampling at each well.
- Avoid sharp edges on well casings.
- If dermal contact occurs with groundwater or the acid used in sample preservation, immediately wash all affected skin thoroughly with soap and water.
- Avoid eating and drinking on site and during sampling.
- Use ear plugs during sampling if sampling involves a generator.
- Containerize all purge water and transport to the appropriate storage area.
- Use two people to transport full coolers/containers whenever possible. If two people are not available use a dolly to move coolers. If the coolers weigh more than 40 pounds Attachment 1 of the HSE-112, *Manual Lifting*, shall be completed by the SC. If the coolers weigh more than 50 pounds they should never be lifted by one person.

## 9.6 Hand and Power Tools

(Reference CH2M HILL, SOP HSE-210, *Hand and Power Tools*)

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are using hand and power tools. Ensure the requirements in the referenced SOP are followed:

- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service;
- Hand tools will be used for their intended use and operated in accordance with manufacturer's instructions and design limitations;
- Maintain all hand and power tools in a safe condition;
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool;
- Do not carry or lower a power tool by its cord or hose;
- Portable power tools will be plugged into GFCI protected outlets;
- Portable power tools will be Underwriters Laboratories (UL) listed and have a three-wire grounded plug or be double insulated;

- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters);
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed;
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials;
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications;
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.); and
- Working with manual and pistol-grip hand tools may involve highly repetitive movement, extended elevation, constrained postures, and/or awkward positioning of body members (for example, hand, wrist, arm, shoulder, neck, etc.). Consider alternative tool designs, improved posture, the selection of appropriate materials, changing work organization, and sequencing to prevent muscular, skeletal, repetitive motion, and cumulative trauma stressors.

### 9.6.1 Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points or any other sources of mechanical injury.
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated and equipment has been locked/tagged and tested.
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lockout of that equipment prior to work.

## 9.7 Portable Generator Hazards

(Reference CH2M HILL SOP HSE-206, Electrical Safety)

- Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.
- NEVER use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of carbon monoxide (CO) very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can't smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.
- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Ensure the generator is grounded in accordance with the manufacturer's operation manual.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.

- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with Ground Fault Circuit Interrupters (GFCI). Test the GFCIs daily to determine whether they are working
- If the generator is not equipped with GFCI protected circuits plug a portable GFCI into the generator and plug appliances, tools and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.
- Each vessel must be equipped with a functioning pressure gauge to monitor pressure.

## 9.8 Pressure Washing Operations

Below are the hazard controls and safe work practices to follow when working around or performing pressure washing.

- Only trained, authorized personnel may operate the high-pressure washer.
- Follow manufacturer's safety and operating instructions.
- Inspect pressure washer before use and confirm deadman trigger is fully operational
- The wand must always be pointed at the work area.
- The trigger should never be tied down
- Never point the wand at yourself or another worker.
- The wand must be at least 42 inches (1.1 meter) from the trigger to the tip and utilize greater than 10 degree tips.
- The operator must maintain good footing.
- Non-operators must remain a safe distance from the operator.
- No unauthorized attachment may be made to the unit.
- Do not modify the wand.
- All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- Polycoated Tyvek or equivalent, 16-inch-high steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn, at a minimum.

## 9.9 Rigging

(Reference CH2M HILL SOP HSE-316, *Rigging*)

Below are the hazard controls and safe work practices to follow when personnel are overseeing or performing rigging. Ensure the requirements in the referenced SOP are followed.

### 9.9.1 General

- All rigging equipment shall be used only for its intended purpose, inspected by a competent person prior to use, and shall not be loaded in excess of its capacity rating. Defective rigging shall be removed from service.

- When CH2M HILL is in control of rigging operations, CH2M HILL shall provide a rigging competent person that will inspect, maintain oversee all rigging operations. The competent person shall use the appropriate rigging inspection log form to inspect wire rope, synthetic slings and/or shackles.
- Tag lines shall be attached to every load being lifted by a crane.
- Rigging equipment shall be protected from flame cutting and electric welding operations, and or contact avoided with solvents and chemicals.
- Rigging equipment, when not in use, shall be stored in an area free from damage caused by environmental elements, hazardous substances, and other factors that may compromise equipment integrity and performance.
- No modification or addition, which that could affect the capacity and or safe operation of the equipment, shall be made without the manufacturer's written approval.
- Rigging equipment shall not be shortened with knots, bolts or other makeshift devices.
- All rigging equipment shall be load tested at least annually by a competent person and documented.
- Special hoisting devices, slings, chokers, hooks, clamps, or other lifting accessories shall be marked to indicate the safe working loads and shall be proof -tested prior to initial use to 125 percent of their rated load. Vendors or suppliers will provide documentation of proof testing documentation.

### 9.9.2 Equipment

- Protruding end strands of wire rope shall be covered or blunted.
- Wire rope shall not be used, if in any length of eight diameters, the number of total number of visible broken wires exceeds 10% percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect.
- When inspecting the end fittings of wire rope slings, if more than one wire in a lay is broken in the fitting, do not use the sling.
- Synthetic web slings shall be immediately removed from service if any of the following conditions are present:
  - acid or caustic burns; melting or charring of any part of the sling
  - surface; snags, punctures, tears or cuts; broken or worn stitches; distortion of fittings;
  - discoloration of or rotting; red warning line showing.
- Never use makeshift hooks, links or other fasteners. Job or shop hooks and links, or makeshift fasteners, formed from bolts, rods, etc., or other such attachments, shall not be used.
- Alloy steel chains shall have permanently affixed identification stating size, grade, rated capacity and reach.
- Shackles and hooks shall be constructed of forged alloy steel with the identifiable load rating on the shackle or hook.

### 9.9.3 Rigging Use

- Rigging shall not be pulled from under a load when the load is resting on the rigging.
- Place sling(s) in center bowl of hook.
- When attaching slings to the load hoist hook, corners and sharp edges should be "packed" to prevent cutting or damaging the rope or slings.
- Never use nylon, polyester, or polypropylene web slings, or web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of acids, caustics or phenolics are present.

- Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20° F to plus 180° F without decreasing the working load limit. For operations outside this temperature range, and for wet frozen slings, the sling manufacturer's recommendations shall be followed.
- When used for eye splices, the U-bolt shall be installed so that the "U" section is in contact with the dead end of the rope.

## 9.10 Utilities (underground)

An assessment for underground utilities must be conducted where there is a potential to contact underground utilities or similar subsurface obstructions during intrusive activities. Intrusive activities include excavation, trenching, drilling, hand augering, soil sampling, or similar activities.

The assessment must be conducted before any intrusive subsurface activity and must include at least the following elements:

1. A background and records assessment of known utilities or other subsurface obstructions.
2. Contacting and using the designated local utility locating service.
3. Conducting an independent field survey to identify, locate, and mark potential underground utilities or subsurface obstructions. *Note: This is independent of, and in addition to, any utility survey conducted by the designated local utility locating service above.*
4. A visual survey of the area to validate the chosen location.

When any of these steps identifies an underground utility within 5 feet (1.5 meters) of intrusive work, then non-aggressive means must be used to physically locate the utility before a drill rig, backhoe, excavator or other aggressive method is used.

Aggressive methods are never allowed within 2 feet of an identified high risk utility (see paragraph below).

Any deviation from these requirements must be approved by the Responsible HS Manager and the Project Manager.

### 9.10.1 Background and Records Assessment of Known Utilities

Identify any client- or location-specific permit and/or procedural requirements (e.g., dig permit or intrusive work permit) for subsurface activities. For military installations, contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Obtain available utility diagrams and/or as-built drawings for the facility.

Review locations of possible subsurface utilities including sanitary and storm sewers, electrical lines, water supply lines, natural gas lines, fuel tanks and lines, communication lines, lighting protection systems, etc. *Note: Use caution in relying on as-built drawings as they are rarely 100 percent accurate.*

Request that a facility contact with knowledge of utility locations review and approve proposed locations of intrusive work.

### 9.10.2 Designated Local Utility Locating Service

Contact your designated local utility locating service (e.g., Dig-Safe, Blue Stake, One Call) to identify and mark the location of utilities. Call 811 in the US or go to [www.call811.com](http://www.call811.com) to identify the appropriate local service group. Contacting the local utility locating service is a legal requirement in most jurisdictions.

### **9.10.3 Independent Field Survey (Utility Locate)**

The organization conducting the intrusive work (CH2M HILL or subcontractor) shall arrange for an independent field survey to identify, locate, and mark any potential subsurface utilities in the work area. This survey is in addition to any utility survey conducted by the designated local utility locating service.

The independent field survey provider shall determine the most appropriate instrumentation/technique or combinations of instrumentation/techniques to identify subsurface utilities based on their experience and expertise, types of utilities anticipated to be present, and specific site conditions.

A CH2M HILL or subcontractor representative must be present during the independent field survey to observe the utility locate and verify that the work area and utilities have been properly identified and marked. If there is any question that the survey was not performed adequately or the individual was not qualified, then arrangements must be made to obtain a qualified utility locate service to re-survey the area. Obtain documentation of the survey and clearances in writing and signed by the party conducting the clearance. Maintain all documentation in the project file.

If the site owner (military installation or client) can provide the independent field survey, CH2M HILL or the subcontractor shall ensure that the survey includes:

- Physically walking the area to verify the work location and identify, locate, and mark underground utility locations;
- Having qualified staff available and instrumentation to conduct the locate;
- Agreeing to document the survey and clearances in writing.
- Should any of the above criteria not be met, CH2M HILL or subcontractor must arrange for an alternate independent utility locate service to perform the survey.
- The markings from utility surveys must be protected and preserved until the markings are no longer required. If the utility location markings are destroyed or removed before intrusive work commences or is completed, the PM, SC, or designee must notify the independent utility locate service or the designated local utility locating service to resurvey and remark the area.

### **9.10.4 Visual Assessment before and during Intrusive Activities**

Perform a "360 degree" assessment. Walk the area and inspect for utility-related items such as valve caps, previous linear cuts, patchwork in pavement, hydrants, manholes, utility vaults, drains, and vent risers in and around the dig area.

The visual survey shall include all surface landmarks, including manholes, previous liner cuts, patchwork in pavement, pad-mounted transformers, utility poles with risers, storm sewer drains, utility vaults, and fire hydrants.

If any unanticipated items are found, conduct further research before initiating intrusive activities and implement any actions needed to avoid striking the utility or obstruction.

### **9.10.5 Subsurface Activities within 5 feet of an Underground Utility or if there is Uncertainty**

When aggressive intrusive activities will be conducted within 5 feet (1.5 meters) of an underground utility or when there is uncertainty about utility locations, locations must be physically verified by non-aggressive means such as air or water knifing, hand digging, or human powered hand augering. Non-conductive tools must be used if electrical hazards may be present. If intrusive activities are within 5 feet (1.5 meters) and parallel to a marked existing utility, the utility location must be exposed and verified by non-aggressive methods every 100 feet (30.5 meters). Check to see if the utility can be isolated during intrusive work.

### 9.10.6 Intrusive Activities within 2 feet of an Underground Utility

Use non-aggressive methods (hand digging, vacuum excavation, etc.) to perform intrusive activities within 2 feet of a high risk utility (i.e., a utility that cannot be de-energized or would cause significant impacts to repair/replace). Hazardous utilities shall be de-energized whenever possible.

### 9.10.7 Spotter

A spotter shall be used to monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon, presence of pea gravel or sand in soils, presence of concrete or other debris in soils, refusal of auger or excavating equipment). If any suspicious conditions are encountered stop work immediately and contact the PM or RHSM to evaluate the situation. The spotter must have a method to alert an operator to stop the intrusive activity (e.g., air horn, hand signals).

## 9.11 Utilities (overhead)

### 9.11.1 Proximity to Power Lines

No work is to be conducted within 50 feet (15.2 meters) of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet (15.2 meters) of overhead power lines without first making this determination.

### 9.11.2 Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:

- Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum clearances shown in the table.

MINIMUM DISTANCES FROM POWERLINES

Powerlines Nominal System Kv	Minimum Required Distance, Feet (Meters)
0-50	10 (3.0)
50-200	15 (4.6)
201-350	20 (6.1)
351-500	25 (7.6)
501-750	35 (10.7)
751-1000	45 (13.7)
Over 1000	Established by utility owner/operator or by a professional engineer in electrical power transmission/distribution

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

- The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the PM prior to the start of work.

# 10 Physical Hazards and Controls

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Physical hazards include exposure to temperature extremes, sun, noise, and radiation. If you encounter a physical hazard that has not been identified in this plan, contact the RHSM so that a revision to this plan can be made.

## 10.1 Noise

(Reference CH2M HILL SOP HSE-108, *Hearing Conservation*)

CH2M HILL is required to control employee exposure to occupational noise levels of 85 decibels, A-weighted, (dBA) and above by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95. A noise assessment may be conducted by the RHSM or designee based on potential to emit noise above 85 dBA and also considering the frequency and duration of the task.

- Areas or equipment emitting noise at or above 90dBA shall be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- Areas or equipment emitting noise levels at or above 85 dBA, hearing protection must be worn.
- Employees exposed to 85 dBA or a noise dose of 50% must participate in the Hearing Conservation program including initial and annual (as required) audiograms.
- The RHSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift (STS) in their hearing.
- Employees who are exposed at or above the action level of 85 dBA are required to complete the online Noise Training Module located on CH2M HILL's virtual office.
- Hearing protection will be maintained in a clean and reliable condition, inspected prior to use and after any occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing protection required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner and a copy of the OSHA standard 29 CFR 1910.95 shall be posted in the workplace.

## 10.2 Ultraviolet Radiation (sun exposure)

Health effects regarding ultraviolet (UV) radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn), photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer. Implement the following controls to avoid sunburn.

### 10.2.1 Limit Exposure Time

- Rotate staff so the same personnel are not exposed all of the time.

- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).
- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

### 10.2.2 Provide Shade

- Take lunch and breaks in shaded areas.
- Create shade or shelter through the use of umbrellas, tents, and canopies.
- Fabrics such as canvas, sailcloth, awning material and synthetic shade cloth create good UV radiation protection.
- Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.

### 10.2.3 Clothing

- Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.
- Head protection should be worn to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or "Foreign Legion" style caps offer added protection.
- Wear UV-protective sunglasses or safety glasses. These should fit closely to the face. Wrap-around style glasses provide the best protection.

### 10.2.4 Sunscreen

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Re-apply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
- Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
- Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off non-waterproof products.
- Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- No sunscreen provides 100 percent protection against UV radiation. Other precautions must be taken to avoid overexposure.

## 10.3 Temperature Extremes

(Reference CH2M HILL SOP HSE-211, *Heat and Cold Stress*)

Each employee is responsible for the following:

- Recognizing the symptoms of heat or cold stress;
- Taking appropriate precautionary measures to minimize their risk of exposure to temperature extremes (see following sections); and
- Communicating any concerns regarding heat and cold stress to their supervisor or SC.

### 10.3.1 Heat

Heat-related illnesses are caused by more than just temperature and humidity factors.

**Physical fitness** influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

**Acclimatization** is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress. Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. With a recent history of heat-stress exposures of at least two continuous hours per day for 5 of the last 7 days to 10 of the last 14 days, a worker can be considered acclimatized. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days and may be completely lost in three to four weeks. Because acclimatization is to the level of the heat-stress exposure, a person will not be fully acclimatized to a sudden higher level; such as during a heat wave.

**Dehydration** reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight).

**Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool—but not cold—water. Call ambulance, and get medical attention immediately!

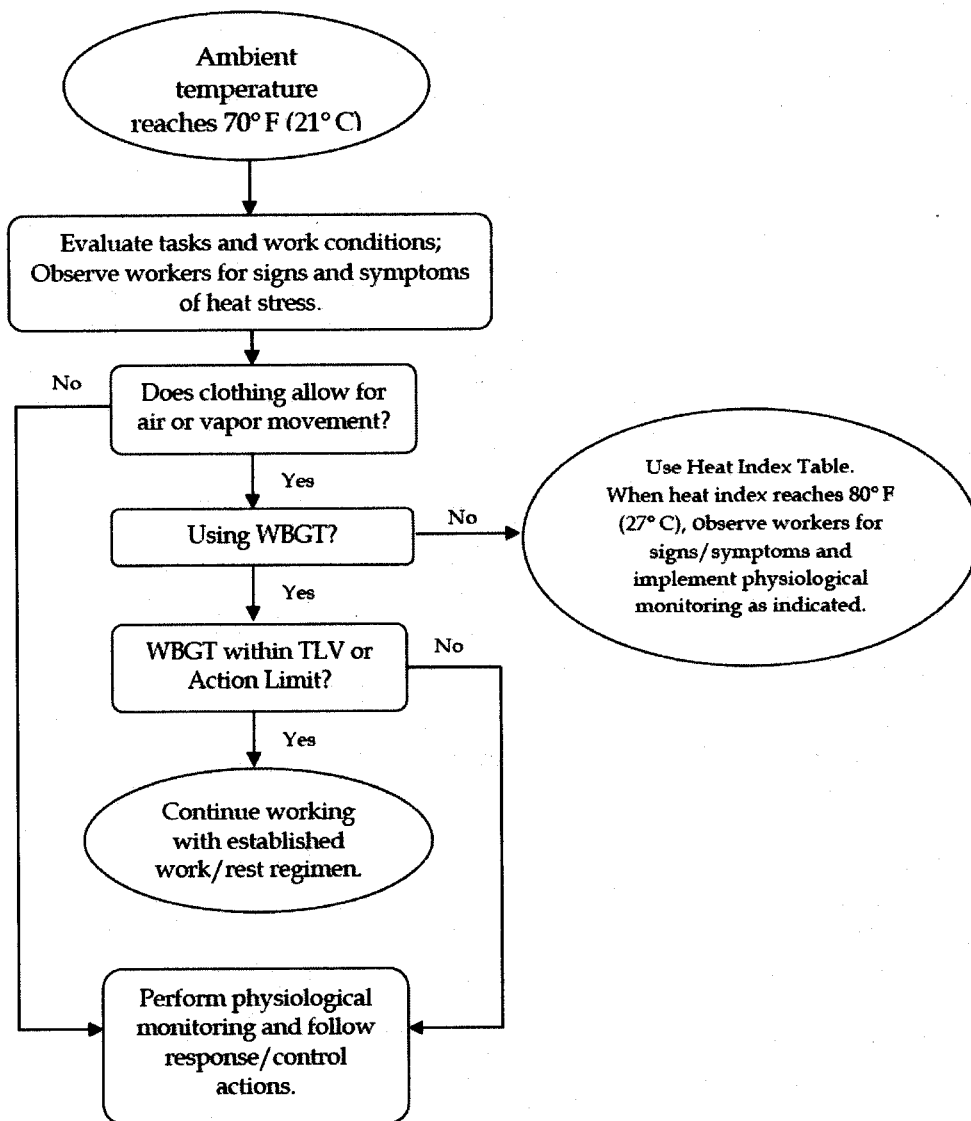
#### 10.3.1.1. Precautions

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°Fahrenheit (10 degrees Celsius [C]) to 60°Fahrenheit (F) (15.6 degrees C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.

- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. PREVENTION and communication is key.

### 10.3.1.2. Thermal Stress Monitoring

#### Thermal Stress Monitoring Flow Chart



#### Thermal Stress Monitoring – Permeable or Impermeable Clothing

When permeable work clothes are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement physiological monitoring as indicated below. This should start when the heat index reaches 80° F (27° C) [see Heat Index Table below], or sooner if

workers exhibit symptoms of heat stress indicated in the table above. These heat index values were devised for shady, light wind conditions; exposure to full sunshine can increase the values by up to 15°F (8°C). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

When wearing **impermeable clothing** (e.g., clothing doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described below shall be conducted when the ambient temperature reaches 70°F (21°C) or at a lower temperature when workers begin to exhibit signs and symptoms of heat stress.

Heat Index	Possible Heat Disorders	Minimum Frequency of Physiological Monitoring
80°F - 90°F (27°C - 32°C)	Fatigue possible with prolonged exposure and/or physical activity	Observe Workers for signs of heat stress and implement physiological monitoring if warranted.
90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity	Every 2 hours, or sooner, if signs of heat stress are observed.
105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.	Every 60 minutes or sooner if signs of heat stress are observed.
130°F or Higher (54°C or Higher)	Heat/Sunstroke highly likely with continued exposure.	Every 30 minutes or sooner if signs of heat stress are observed.
Source: National Weather Service		

### Physiological Monitoring and Associated Actions

The following physiological monitoring protocol below, using either radial pulse or aural temperature, will occur when the heat index is 80 degrees F or greater (or when personnel exhibit signs of heat stress), the following will be performed:

- The sustained heart rate during the work cycle should remain below 180 beats per minute (bpm) minus the individual's age (e.g. 180 – 35 year old person = 145 bpm). The sustained heart rate can be estimated by measuring the heart rate at the radial pulse for 30 seconds as quickly as possible prior to starting the rest period.
- The heart rate after one minute rest period should not exceed 120 beats per minute (bpm).
- If the heart rate is higher than 120 bpm, the next work period should be shortened by 33 percent, while the length of the rest period stays the same.
- If the pulse rate still exceeds 120 bpm at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.
- Continue this procedure until the rate is maintained below 120 bpm.
- Alternately, the body temperature can be measured, either oral or aural (ear), before the workers have something to drink.
- If the oral or aural temperature exceeds 99.6° F (37.6 ° F) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral or aural (ear) temperature is maintained below 99.6 ° F (37.6° C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field, however, a digital aural (aural) thermometer is easy to obtain and inexpensive to purchase.
- Use the form attached to this HSP to track workers' measurements and actions taken.

## Procedures for when Heat Illness Symptoms are Experienced

- **Always** contact the RHSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.
- In the case of all other heat-related symptoms (fainting, heat rash, heat exhaustion), and if the worker is a CH2M HILL worker, contact the occupational physician at 1-866-893-2514 and immediate supervisor.
- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, follow precautions under the emergency medical treatment of this HSP.
- Follow the Incident Notification, Reporting, and Investigation section of this HSP.

## 10.3.2 Cold

### 10.3.2.1. General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

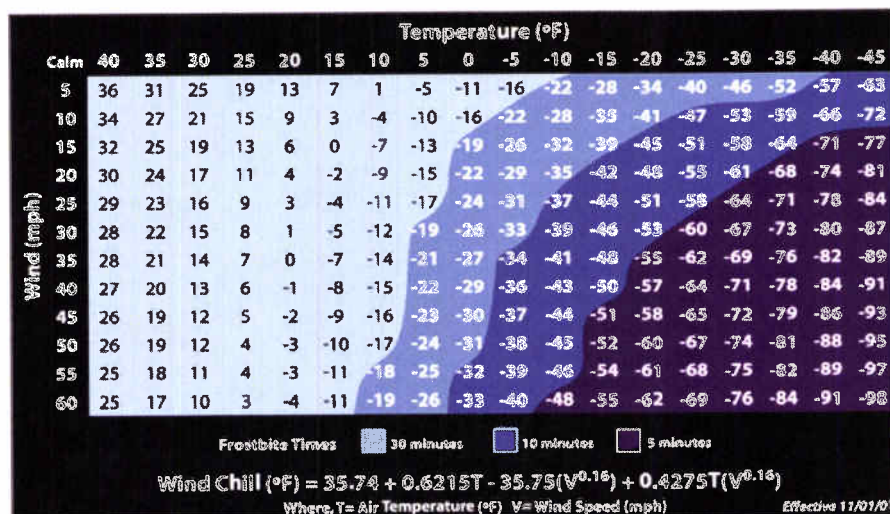
### 10.3.2.2. Precautions

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-Chill Index (below) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor/PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm—but not hot—water. Have victim drink warm fluids, but not coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.



## Wind Chill Chart



## 10.4 Radiological Hazards

Refer to CH2M HILL's Core Standard, Radiological Control and Radiological Controls Manual for additional requirements.

Hazards	Controls
None Known	None Required

# 11 Biological Hazards and Controls

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Biological hazards are everywhere and change with the region and season. If you encounter a biological hazard that has not been identified in this plan, contact the RHSM so that a revision to this plan can be made. Whether it is contact with a poisonous plant, a poisonous snake, or a bug bite, do not take bites or stings lightly. If there is a chance of an allergic reaction or infection, or to seek medical advice on how to properly care for the injury, contact the occupational nurse at 1-866-893-2514.

## 11.1 Bees and Other Stinging Insects

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform your supervisor and/or a buddy. If you are stung, contact the occupational nurse at 1-866-893-2514. If a stinger is present, remove it as soon as possible using something with a thin, hard edge (e.g., credit card) to scrape the stinger out. Be sure to sanitize the object first with hand sanitizer, alcohol or soap and water. Wash and disinfect the wound, cover it, and apply ice. Watch for an allergic reaction if you have never been stung before. Call 911 if the reaction is severe.

## 11.2 Feral Dogs

Avoid all dogs – both leashed and stray. Do not disturb a dog while it is sleeping, eating, or caring for puppies. If a dog approaches to sniff you, stay still. An aggressive dog has a tight mouth, flattened ears and a direct stare. If you are threatened by a dog, remain calm, do not scream and avoid eye contact. If you say anything, speak calmly and firmly. Do not turn and run, try to stay still until the dog leaves, or back away slowly until the dog is out of sight or you have reached safety (e.g. vehicle). If attacked, retreat to vehicle or attempt to place something between you and the dog. If you fall or are knocked to the ground, curl into a ball with your hands over your head and neck and protect your face. If bitten, contact the occupational nurse at 1-866-893-2514. Report the incident to the local authorities.

## 11.3 Fire Ants

There are several types of fire ants in the United States that can cause painful bites and allergic reactions. Fire ants aggressively defend their nests by stinging several times after climbing on their victims. Large ant mounds are easily visible, but there can be smaller mounds or nests with little “worked” soil that can be stepped on inadvertently. They can also be under rocks, wood or other debris. Implement the following when fire ants are observed:

- Be aware of fire ants and take care not to stand on ant nests;
- Use insect repellents on clothing and footwear to temporarily discourage ants from climbing; and
- Tuck pants into socks.

If stung, get away from the area you are standing on, briskly brush off ants—wash affected area with soap. Call the occupational nurse.

## 11.4 Giant Hogweed

Giant hogweed is a noxious weed that has become established in New York, Pennsylvania, Ohio, Maryland, Oregon, Washington, Michigan, Virginia, Vermont, New Hampshire Maine, and adjacent areas of Canada, but can be spread to surrounding areas.

Its sap, in combination with moisture and sunlight, can cause phytophotodermatitis—a serious skin inflammation and severe eye irritation leading to blindness. Contact between the skin and the sap of this plant occurs either

through brushing against the bristles on the stem or breaking the stem or leaves. Eye exposure to the sap can occur during the breaking of the stems (during clearing/grubbing). Heat, sunlight, and moisture worsen the skin reaction.

Giant hogweed is a biennial or perennial which can grow up to 12 feet (approximately 3.5 meters) or more. Its hollow, ridged stems grow 2-4 inches (5-10 cm) in diameter and have dark reddish-purple blotches. Its large compound leaves can grow up to five feet (1.5 meters) wide. Its white flower heads can grow up to 2.5 feet (approximately 1 meter) in diameter.

Symptoms of exposure include initial itching and redness, then painful blisters form within 48 hours with the area becoming dark and pigmented. Long-term effects include scarring, sensitivity of the affected area to sunlight, temporary or permanent blindness if it gets into the eyes.

As with all hazardous plants, recognition and avoidance is key. Do not touch any portion of the plant. Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and cold water immediately. Keep exposed area away from sunlight for 48 hours. Contact the occupational nurse immediately.



## 11.5 Hantavirus

Hantavirus pulmonary syndrome (HPS) is a disease caused by a virus which can be transmitted from certain rodents to humans and is prevalent throughout the United States. Avoid disturbing rodent nests. Contact is most likely to occur when there is a current rodent infestation in things like control boxes, storage sheds, wellheads, remediation equipment, or trailers. Once excreted into the environment by the rodent, hantaviruses can survive in the environment and remain infectious for a period of 2-3 days. Ultraviolet rays in sunlight inactivate hantaviruses.

Nesting material and droppings must be removed if work is necessary in a rodent-infested area. PPE for removal shall include:

- Tyvek coveralls;
- Rubber boots or disposable shoe covers;
- Rubber, latex, or vinyl gloves;

- Respiratory protection such as a full face or half-mask air-purifying respirator with a high-efficiency particulate air (HEPA) filter; and
- Protective goggles if wearing a half-mask respirator.

Spray any urine, droppings, and nesting materials with either a bleach and water solution (1 parts bleach to 9 parts water) or a household disinfectant prepared according to the label instructions for dilution and disinfection time. Soak well and let stand for 15 minutes. Use a paper towel or rag to pick up the materials and dispose of them.

Mop floors after spraying them using bleach and water solution or a disinfectant. Dirt floors can be sprayed with either bleach and water solution or a disinfectant.

Personal protective gear shall be decontaminated upon removal at the end of the day. All potentially infective waste material (including respirator filters) from clean-up operations shall be double-bagged in plastic bags.

### 11.5.1 Symptoms of HPS

Symptoms develop between 14 and 31 days after exposure to infected rodents and include fatigue, fever, and muscle aches, especially the large muscle groups--thighs, hips, back and sometimes shoulders. About half of all HPS patients also experience headaches, dizziness, chills and/or abdominal pain. Four to 10 days after the initial phase of the illness, late symptoms of HPS may appear. These include coughing and shortness of breath. If you develop symptoms suggestive of HPS, call the occupational nurse at 1-866-893-2514.

## 11.6 Mosquito Bites

Due to the recent detection of the West Nile Virus in the southwestern United States it is recommended that preventative measures be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent:

- Stay indoors at dawn, dusk, and in the early evening;
- Wear long-sleeved shirts and long pants whenever you are outdoors;
- Spray clothing with repellents containing permethrin or N,N-diethyl-meta-toluamide (DEET) since mosquitoes may bite through thin clothing;
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET. Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands; and
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

### 11.6.1 Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3 to 15 days.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor, PM, and contact the occupational nurse at 1-866-893-2514.

## 11.7 Poison Ivy, Poison Oak, and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Shrubs are usually 12 to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in spring and summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in fall, but plants lose its (yellowed, then brown) leaves in winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons. These plants contain urushiol a colorless or pale yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems and leaves and causes allergic skin reactions when contacted. The oil is active year round.

Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

*Poison Ivy*



*Poison Sumac*



*Poison Oak*



Contamination with poison ivy, sumac or oak can happen through several pathways, including:

- Direct skin contact with any part of the plant (even roots once above ground foliage has been removed).
- Contact with clothing that has been contaminated with the oil.
- Contact from removing shoes that have been contaminated (shoes are coated with urushiol oil).
- Sitting in a vehicle that has become contaminated.
- Contact with any objects or tools that have become contaminated.
- Inhalation of particles generated by weed whacking, chipping, vegetation clearing.

If you must work on a site with poison ivy, sumac or oak the following precautions are necessary:

- Do not drive vehicles onto the site where it will come into contact with poison ivy, sumac or oak. Vehicles which need to work in the area, such as drill rigs or heavy equipment must be washed as soon as possible after leaving the site.
- All tools used in the poison ivy, sumac or oak area, including those used to cut back poison oak, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated before they are placed back into the site vehicle. If on-site decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated.
- Personal protective equipment, including Tyvek coveralls, gloves, and boot covers must be worn. PPE must be placed into plastic bags and sealed if they are not disposed immediately into a trash receptacle.
- As soon as possible following the work, shower to remove any potential contamination. Any body part with suspected or actual exposure should be washed with Zanol, Tecnu or other product designed for removing

urishiol. If you do not have Zanfel or Tecnu wash with cold water. Do not take a bath, as the oils can form and invisible film on top of the water and contaminate your entire body upon exiting the bath.

- Tecnu may also be used to decontaminate equipment.
- Use IvyBlock or similar products to prevent poison oak, ivy and sumac contamination. Check with the closest CH2M HILL warehouse to see if these products are available. Follow all directions for application.

If you do come into contact with one of these poisonous plants and a reaction develops, contact your supervisor and the occupational nurse 1-866-893-2514.

## 11.8 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Call the occupational nurse at 1-866-893-2514 immediately. Do not apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings. Below is a guide to identifying poisonous snakes from non-poisonous snakes.

### Identification of Poisonous Snakes

Major Identification Features Non-venomous Snake	Major Identification Features Venomous Snake
1. Round pupils	1. Elliptical pupils
2. No sensing pit	2. Sensing pit between eye and nostril
3. Head slightly wider than neck	3. Head much wider than neck
4. Divided anal plate	4. Single anal plate
5. Double row of scales on the underside of the tail	5. Single scales on the underside of the tail

## 11.9 Spiders - Brown Recluse and Widow

The Brown Recluse spider can be found most anywhere in the United States. It varies in size in shape, but the distinguishing mark is the violin shape on its body. They are typically non-aggressive. Keep an eye out for irregular, pattern-less webs that sometimes appear almost tubular built in a protected area such as in a crevice or between two rocks. The spider will retreat to this area of the web when threatened.

The Black Widow, Red Widow and the Brown Widow are all poisonous. Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale or have lateral stripes), with moderately long, slender legs. These spiders are nocturnal and build a three-dimensional tangled web, often with a conical tent of dense silk in a corner where the spider hides during the day.

### 11.9.1 Hazard Controls

- Inspect or shake out any clothing, shoes, towels, or equipment before use.
- Wear protective clothing such as a long-sleeved shirt and long pants, hat, gloves, and boots when handling stacked or undisturbed piles of materials.
- Minimize the empty spaces between stacked materials.
- Remove and reduce debris and rubble from around the outdoor work areas.
- Trim or eliminate tall grasses from around outdoor work areas.
- Store apparel and outdoor equipment in tightly closed plastic bags.
- Keep your tetanus boosters up-to-date (every 10 years). Spider bites can become infected with tetanus spores.

If you think you have been bit by a poisonous spider, immediately call the occupational nurse at 1-866-893-2514 and follow the guidance below:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood;
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite;
- Elevate the bitten area, if possible;
- Do not apply a tourniquet, do not try to remove venom; and
- Try to positively identify the spider to confirm its type. If the spider has been killed, collect it in a plastic bag or jar for identification purposes. Do not try to capture a live spider—especially if you think it is a poisonous spider.

Black Widow



Red Widow



Brown Widow



Brown Recluse



If you are stung by a scorpion, call the occupational nurse 1-866-893-2514 and try to note the description of the scorpion. Cleanse the sting area and apply ice.

## 11.10 Stinging Caterpillars



If you find a fuzzy or spiny caterpillar which inflicts a painful sting upon contact, you probably have found a stinging caterpillar. The intensity of the irritation, whether it is caused by “venomous” or “irritating” hairs or barbed hooks and/or sharp, hollow spines, will be dependent on the species of caterpillar and the individual’s sensitivity. Reaction ranges from mild, with local reddening, swelling and itching, to rather severe depending on the susceptibility of the individual, the tenderness of the skin and the place of contact, and may even require hospital care for unusually sensitive persons. Hypersensitive persons may experience

symptoms and/or allergic reactions, e.g., severe swelling, nausea, difficulty in breathing and generalized systemic reaction.

Saddleback caterpillars are an example of a stinging caterpillar. These are prevalent along the east coast from Florida to Massachusetts. They are most active within August and September. Contact with this caterpillar may produce a rash and a high fever.

Stings usually occur when people brush against a caterpillar or attempt to remove it from their body or their clothing. Only a few of the many thousand caterpillars can sting.

Avoid handling any hairy caterpillars or material with which they have been in contact. Suitable protective clothing, including safety glasses and gloves should always be worn if handling these insects are necessary. Remember, dead caterpillars can still cause painful stings. Most caterpillar infestations are usually short lived and should be left undisturbed, unless they are causing a problem. All the moth larvae are leaf feeders, which is where they can be found. Infested shrubs and trees may be vacuumed or sprayed or dusted to reduce or eliminate the caterpillars. Contact the RHSM if caterpillars are abundant and cannot be avoided to determine if spraying foliage or removal of caterpillars is necessary.

If you are stung, call the occupational nurse at 1-866-893-2514. Applying tape, such as adhesive or duct or cellophane transparent and pulling it off may be helpful in removing broken spines. Washing the affected skin area thoroughly with soap and water may also help to remove insect hairs/spines and/or irritating venom. Prompt application of an ice pack and a baking soda poultice may help to reduce pain and prevent swelling.

## 11.11 Ticks

Every year employees are exposed to tick bites at work and at home putting them at risk of illness. Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch (6.4 mm) in size.

In some geographic areas exposure is not easily avoided. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permethrin and spray skin with only DEET; and check yourself frequently for ticks.

Where site conditions (vegetation above knee height, tick endemic area) or when tasks (having to sit or kneel in vegetation) diminish the effectiveness of the other controls mentioned above, bug-out suits (check with your local or regional warehouse) or Tyvek shall be used. Bug-out suits are more breathable than Tyvek.

Take precautions to avoid exposure by including pre-planning measures for biological hazards prior to starting field work. Avoid habitats where possible, reduce the abundance through habitat disruption or application of acaricide. If these controls aren’t feasible, contact your local or regional warehouse for preventative equipment such as repellants, protective clothing and tick removal kits. Use the buddy system and perform tick inspections

prior to entering the field vehicle. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented.

See Tick Fact Sheet attached to this HSP for further precautions and controls to implement when ticks are present. If bitten by a tick, follow the removal procedures found in the tick fact sheet, and call the occupational nurse at 1-866-893-2514.

Be aware of the symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme disease is a rash that might appear that looks like a bull's eye with a small welt in the center. RMSF is a rash of red spots under the skin 3 to 10 days after the tick bite. In both RMSF and Lyme disease, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, again contact the occupational nurse at 1-866-893-2514.

Be sure to complete an Incident Report (either use the Hours and Incident Tracking System [HITS] system on the VO) if you do come in contact with a tick.

## 12 Contaminants of Concern

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The table below summarizes the potential contaminants of concern (COC) and their occupational exposure limit and signs and symptoms of exposure. The table also includes the maximum concentration of each COC and the associated location and media that was sampled (groundwater, soil boring, surface soil). These concentrations were used to determine engineering and administrative controls described in the "Project-Specific Hazard Controls" section of this HSP, as well as PPE and site monitoring requirements.

Contaminants of Concern					
Contaminant	Location and Maximum <sup>a</sup> Concentration (ppm)	Exposure Limit <sup>b</sup>	IDLH <sup>c</sup>	Symptoms and Effects of Exposure	PIP <sup>d</sup> (eV)
Arsenic	GW: 147	0.01 mg/m <sup>3</sup>	5 mg/ m <sup>3</sup> as As Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Carbon Disulfide	GW: 4,700	1 ppm	500 ppm	dizziness, headache, poor sleep, lassitude, anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects	10.08
Carbon Tetrachloride	GW: 100,000	5 ppm	200 Ca	Central nervous system (CNS) depression, nausea, vomiting, eye and skin irritation, liver and kidney injury, drowsiness, dizziness	11.47
Chloroform	GW: 39,000	10 ppm	500 Ca	Dizziness, mental dullness, nausea, confusion, disorientation, headache, fatigue, eye and skin irritation, anesthesia, enlarged liver	11.42
1,2-Dichloroethane (Ethylene Dichloride)	GW: 61	1 ppm	50 Ca	CNS depression, nausea, vomiting, dermatitis, eye irritation, liver, kidney, and CNS damage; corneal opacity	11.05
Cis-1,2-Dichloroethane	GW 120	200	1000	irritation eyes, respiratory system; central nervous system depression	9.65
1,1,2,2-Tetrachloroethane (Tetrachlorethane)	GW: 8	1 ppm	100 Ca	Nausea, vomiting, abdominal pain, finger tremors, jaundice, hepatitis, liver tenderness, monocytosis, kidney damage, dermatitis	11.10
Tetrachloroethylene (PCE)	GW: 2,700	25 ppm	150 Ca	Eye, nose, and throat irritation; nausea; flushed face and neck; vertigo; dizziness; sleepiness; skin redness; headache; liver damage	9.32
Trichloroethylene (TCE)	GW: 210	10 ppm	1,000 Ca	Headache, vertigo, visual disturbance, eye and skin irritation, fatigue, giddiness, tremors, sleepiness, nausea, vomiting, dermatitis, cardiac arrhythmia, paresthesia, liver injury	9.45
Footnotes: <sup>a</sup> Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water). <sup>b</sup> Appropriate value of permissible exposure limit (PEL), recommended exposure limit (REL), or threshold limit value (TLV) listed. <sup>c</sup> IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen. <sup>d</sup> PIP = photoionization potential; NA = Not applicable; UK = Unknown. eV = electron volt mg/kg = milligram per kilogram mg/m <sup>3</sup> = milligrams per cubic meter ug/m <sup>3</sup> = micrograms per cubic meter					
Potential Routes of Exposure					
<b>Dermal:</b> Contact with contaminated media. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of PPE.		<b>Inhalation:</b> Vapors and contaminated particulates. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of respiratory protection when other forms of control do not reduce the potential for exposure.		<b>Other:</b> Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).	

# 13 Site Monitoring

(Reference CH2M HILL SOP HSE-207, *Exposure Monitoring for Airborne Chemical Hazards*)

When performing site monitoring, record all the information, such as in a field logbook. Note date and time, describe monitoring location (for example, in breathing zone, at source and site location), and what the reading is. If any action levels are reached, note it in the field logbook and note the action taken.

Exposure records (air sampling) must be preserved for the duration of employment plus thirty years. Ensure that copies of the field log book are maintained in the project file.

Copies of all project exposure records (e.g., copies of field logbook pages where air monitoring readings are recorded and associated calibration) shall be sent to the regional SPA for retention and maintained in the project files.

## 13.1 Direct Reading Monitoring Specifications

Instrument	Tasks	Action Levels <sup>a</sup>	Action to be Taken when Action Level reached	Frequency <sup>b</sup>	Calibration
PID: MiniRAE PID with 11.7 eV lamp or equivalent	Air knifing, MIP sampling, direct push sampling, MW installation, GW sampling, any intrusive work	0-5 ppm 5-25 ppm	Level D Level C Stop work, notify HSM	Initially and periodically during intrusive/sampling tasks.	Daily
Detector Tubes: Carbon Tetrachloride specific (0.2 to 70 ppm range) with pretube or equivalent.	Opening wells during GW sampling, intrusive work.	<2 ppm >2ppm	Level D Level C, Stop work notify HSM	Initially and periodically when PID/FID >2 ppm	Not applicable
Chloroform specific (2-10ppm)					
Noise-Level Monitor <sup>d</sup>	Drilling	<85 dB(A) 85-120 dB(A) 120 dB(A)	No action required Hearing protection required Stop; re-evaluate	Initially and periodically during task	Daily

<sup>a</sup> Action levels apply to sustained breathing-zone measurements above background.

<sup>b</sup> The exact frequency of monitoring depends on field conditions and is to be determined by the SC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate.

<sup>c</sup> If the measured percent of O<sub>2</sub> is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O<sub>2</sub> action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O<sub>2</sub> action levels are required for confined-space entry.

<sup>d</sup> Noise monitoring and audiometric testing also required.

## 13.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	0.5 lpm reg T-tubing
Sound Level Meter	Refer to Instrument Manual on site.			

Calibrate air monitoring equipment daily (or prior to use) in accordance with the instrument's instructions. Document the calibration in the field logbook (or equivalent) and include the following information:

- Instrument name
- Serial Number
- Owner of instrument (for example, CH2M HILL, HAZCO)
- Calibration gas (including type and lot number)
- Type of regulator (for example, 1.5 lpm)
- Type of tubing (for example, direct or T-tubing)
- Ambient weather condition (for example, temperature and wind direction)
- Calibration/instrument readings
- Operator's name and signature
- Date and time

## **13.3 Integrated Personal Air Sampling**

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the RHSM immediately if these contaminants are encountered.

### **13.3.1 Method Description**

Initially not required, if upgrade to Level C is required monitoring may be required as determined by HSM.

### **13.3.2 Personal Breathing Zone and Area Samples**

Personal breathing zone and area sampling results must be sent immediately to the RHSM.

Employees potentially exposed to the substances for which air sampling is being performed shall be given the opportunity to observe the exposure measurements, and records shall be made available to all affected employees upon request or when they are required to be provided by a specific regulation. Employees may also receive a copy of their exposure records from the Medical Surveillance Program Administrator (MSPA).

# 14 Personal Protective Equipment

(Reference CH2M HILL- SOP HSE-117, *Personal Protective Equipment*)

## 14.1 Required Personal Protective Equipment

PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.

A PPE assessment has been conducted by the RHSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the RHSM that approved this plan. Below are items that need to be followed when using any form of PPE:

- Employees must be trained to properly wear and maintain the PPE;
- Employees must be trained in the limitations of the PPE;
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area;
- Areas requiring PPE should be posted or employees must be informed of the requirements in an equivalent manner;
- PPE must be inspected prior to use and after any occurrence to identify any deterioration or damage;
- PPE must be maintained in a clean and reliable condition;
- Damaged PPE shall not be used and must either be repaired or discarded; and
- PPE shall not be modified, tampered with, or repaired beyond routine maintenance.

The table below outlines PPE to be used according to task based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the RHSM so this table can be updated.

Project-Specific Personal Protective Equipment Requirements<sup>a</sup>

Task	Level	Body	Head	Respirator <sup>b</sup>
Surveying, Utility locate	D	Work clothes; safety toed leather work boots and gloves	Hardhat <sup>c</sup> Safety glasses with side shields Ear protection <sup>d</sup>	None required
MIP sampling, direct push sampling, MW installation, GW sampling, any intrusive work		Work clothes or cotton coveralls Boots: Safety-toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.  OR	Hardhat <sup>c</sup> Safety glasses with side shields Ear protection <sup>d</sup>	
	Modified D	Work Clothes or Coveralls. SC to determine body protection based on potential contact with site contaminants. If outer layer of personal clothing cannot be kept clean, then outer cotton coveralls or uncoated Tyvek coveralls shall be worn. (Polycoated Tyvek when there is potential to contact contaminated groundwater or free liquids from drums.)		None required

### Project-Specific Personal Protective Equipment Requirements<sup>a</sup>

Task	Level	Body	Head	Respirator <sup>b</sup>
Air Knifing	Modified D	Coveralls: Uncoated Tyvek® Boots: Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat <sup>c</sup> Splash shield <sup>c</sup> Safety glasses with side shields Ear protection <sup>d</sup>	None required.
Work near vehicular traffic ways or earth moving equipment.	All	Appropriate level of ANSI/ISEA 107-2010 high-visibility safety vests.	Work near vehicular traffic ways or earth moving equipment.	
Equipment decontamination if using pressure washer	Modified D with splash protection	Coveralls: Polycoated Tyvek® Boots: 16-inch-high steel-toed rubber boots Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat <sup>c</sup> Splash shield <sup>c</sup> over safety glasses with side shields or splash goggles Ear protection <sup>d</sup>	None required.
	C	Coveralls: Polycoated Tyvek® Boots: Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat <sup>c</sup> Splash shield <sup>c</sup> Ear protection <sup>d</sup> Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; [GMC-H] <sup>e</sup> .

### Reasons for Upgrading or Downgrading Level of Protection (with approval of the RHSM)

Upgrade <sup>f</sup>	Downgrade
<ul style="list-style-type: none"> <li>Request from individual performing tasks.</li> <li>Change in work tasks that will increase contact or potential contact with hazardous materials.</li> <li>Occurrence or likely occurrence of gas or vapor emission.</li> <li>Known or suspected presence of dermal hazards.</li> <li>Instrument action levels in the "Site Monitoring" section exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>New information indicating that situation is less hazardous than originally thought.</li> <li>Change in site conditions that decrease the hazard.</li> <li>Change in work task that will reduce contact with hazardous materials.</li> </ul>

<sup>a</sup> Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

<sup>b</sup> No facial hair that would interfere with respirator fit is permitted.

<sup>c</sup> Hardhat and splash-shield areas are to be determined by the SC.

<sup>d</sup> Ear protection should be worn when conversations cannot be held at distances of 3 feet (1 meter) or less without shouting

<sup>e</sup> See cartridge change-out schedule.

<sup>f</sup> Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the RHSM, and an SC qualified at that level is present.

## 14.2 Respiratory Protection

(Reference CH2M HILL SOP HSE-121, *Respiratory Protection*)

Implement the following when using respiratory protection:

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR);
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used;

- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months;
- Respirator use shall be limited to those activities identified in this plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan;
- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use;
- Canisters/cartridges shall be replaced according to the change-out schedule specified in this plan. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade;
- Respirators in regular use shall be inspected before each use and during cleaning;
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition;
- Respirators shall be properly stored to protect against contamination and deformation;
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service;
- When breathing air is supplied by cylinder or compressor, the SC or RHSM shall verify the air meets Grade D air specifications; and
- The SC or designee shall complete the Self-Assessment Checklist – Respiratory Protection included in as attachment to t+++++.his plan to verify compliance with CH2M HILL's respiratory protection program.

#### **Respirator Change-Out Schedule**

Contaminant	Change-Out Schedule
All	End-of-service life or end of shift (whichever occurs first)

# 15 Worker Training and Qualification

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## 15.1 CH2M HILL Worker Training

(Reference CH2M HILL SOP HSE-110, *Training*)

### 15.1.1 Hazardous Waste Operations Training

All employees engaging in hazardous waste operations or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65. At a minimum, the training shall have consisted of instruction in the topics outlined in 29 CFR 1910.120 and 29 CFR 1926.65. Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities.

#### 15.1.1.1. Initial Training

General site workers engaged in hazardous waste operations shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations, unless otherwise noted in the above-referenced standards.

Employees who may be exposed to health hazards or hazardous substances at treatment, storage, and disposal (TSD) operations shall receive a minimum of 24 hours of initial training to enable the employee to perform their assigned duties and functions in a safe and healthful manner.

Employees engaged in emergency response operations shall be trained to the level of required competence in accordance with 29 CFR 1910.120.

#### 15.1.1.2. Three-Day Actual Field Experience

General site workers for hazardous waste operations shall have received three days of actual experience (on-the-job training) under the direct supervision of a trained, qualified supervisor and shall be documented. If the field experience has not already been received and documented at a similar site, this supervised experience shall be accomplished and documented at the beginning of the assignment of the project.

#### 15.1.1.3. Refresher Training

General site workers and TSD workers shall receive 8-hours of refresher training annually (within the previous 12-month period) to maintain qualifications for fieldwork. Employees engaged in emergency response operations shall receive annual refresher training of sufficient content and duration to maintain their competencies or shall demonstrate competency in those areas at least annually.

#### 15.1.1.4. Eight-Hour Supervisory Training

On site management or supervisors who will be directly responsible for, or supervise employees engaged in hazardous waste site operations, will have received at least 8 hours of additional specialized training on managing such operations. Employees designated as Safety Coordinator – Hazardous Waste are considered 8-hour HAZWOPER Site Safety Supervisor trained.

### 15.1.2 First Aid/Cardiopulmonary Resuscitation

First aid and CPR training consistent with the requirements of a nationally recognized organization such as the American Red Cross Association or National Safety Council shall be administered by a certified trainer. A

minimum of two personnel per active field operation will have first aid and CPR training. Bloodborne pathogen training located on CH2M HILL's Virtual Office is also required for those designated as first aid/CPR trained.

### **15.1.3 Safety Coordinator Training**

SCs are trained to implement the HSE program on CH2M HILL field projects. A qualified SC is required to be identified in the site-specific HSP for CH2M HILL field projects. SCs must also meet the requirements of the worker category appropriate to the type of field project (construction or hazardous waste). In addition, the SCs shall have completed additional safety training required by the specific work activity on the project that qualifies them to implement the HSE program (for example, fall protection, excavation).

### **15.1.4 Site-Specific Training**

Prior to commencement of field activities, all field personnel assigned to the project will have completed site-specific training that will address the contents of applicable HSPs, including the activities, procedures, monitoring, and equipment used in the site operations. Site-specific training will also include site and facility layout, potential hazards, risks associated with identified emergency response actions, and available emergency services. This training allows field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and work operations for their particular activity.

### **15.1.5 Project-Specific Training Requirements**

Project-specific training for this project includes:

- HSPs/AHAs

## **16 Medical Surveillance and Qualification**

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(Reference CH2M HILL SOP HSE-113, *Medical Surveillance*)

All site workers participating in hazardous waste operations or emergency response (HAZWOPER) will maintain an adequate medical surveillance program in accordance with 29 CFR 1910.120 or 29 CFR 1926.65 and other applicable OSHA standards. Documentation of employee medical qualification (e.g., physician's written opinion) will be maintained in the project files and made available for inspection.

### **16.1 Hazardous Waste Operations and Emergency Response**

CH2M HILL personnel expected to participate in on site HAZWOPER tasks are required to have a current medical qualification for performing this work. Medical qualification shall consist of a qualified physician's written opinion regarding fitness for duty at a hazardous waste site, including any recommended limitations on the employee's assigned work. The physician's written opinion shall state whether the employee has any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

### **16.2 Job or Site-Specific Medical Surveillance**

Due to the nature of hazards for a particular job or work site, specialized medical surveillance may be necessary. This surveillance could include biological monitoring for specific compounds, or specialized medical examinations.

Site-specific medical surveillance includes:

- None.

### **16.3 Respirator User Qualification**

Personnel required to wear respirators must have a current medical qualification to wear respirators. Medical qualification shall consist of a qualified physician's written opinion regarding the employee's ability to safely wear a respirator in accordance with 29 CFR 1910.134.

### **16.4 Hearing Conservation**

Personnel working in hazardous waste operations or operations that fall under 29 CFR 1910.95 and exposed to noise levels in excess of the 85dBA time-weighted average shall be included in a hearing conservation program that includes annual audiometric testing.

# 17 Site-Control Plan

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## 17.1 Site-Control Procedures

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas.

The SC will implement site control procedures including the following bulleted items.

- Establish support, contamination reduction, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals;
  - Air horn; and
  - Two-way radio or cellular telephone if available.
- Establish offsite communication.
- Establish and maintain the “buddy system.”

## 17.2 Remediation Work Area Zones

(Reference CH2M HILL SOP HSE-218 Hazardous Waste Operations)

A three-zone approach will be used to control areas where site contaminants exist. Access will be allowed only after verification of appropriate training and medical qualification. The three-zone approach shall include an EZ, Contamination Reduction Zone (CRZ) and a Support Zone (SZ). The three-zone approach is not required for construction work performed outside contaminated areas where control of site contamination is not a concern.

Specific work control zones shall be established as necessary during task planning. Site work zones should be modified in the field as necessary, based on such factors as equipment used, air monitoring results, environmental conditions, or alteration of work plans. The following guidelines shall be used for establishing and revising these preliminary zone designations.

### 17.2.1 Support Zone

The SZ is an uncontaminated area (trailers, offices, field vehicles, etc.) that will serve as the field support area for most operations. The SZ provides field team communications and staging for emergency response. Appropriate sanitary facilities and safety and emergency response equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged and decontaminated materials, or personnel with medical emergencies that cannot be decontaminated.

### 17.2.2 Contamination Reduction Zone

The CRZ is established between the EZ and the SZ, upwind of the contaminated area where possible. The CRZ provides an area for decontamination of personnel, portable handheld equipment and tools, and heavy equipment. In addition, the CRZ serves as access for heavy equipment and emergency support services.

### **17.2.3 Exclusion Zone**

The EZ is where activities take place that may involve exposure to site contaminants and/or hazardous materials or conditions. This zone shall be demarcated to prevent unauthorized entry. More than one EZ may be established if there are different levels of protection to be employed or different hazards that exist in the same work area. The EZ shall be large enough to allow adequate space for the activity to be completed, including field personnel and equipment, as well as necessary emergency equipment.

The EZ shall be demarcated with some form of physical barrier or signage. The physical barrier or signage shall be placed so that they are visible to personnel approaching or working in the area. Barriers and boundary markers shall be removed when no longer needed.

### **17.2.4 Other Controlled Areas**

Other work areas may need to be controlled due to the presence of an uncontrolled hazard, to warn workers of requirements, or to prevent unauthorized entry. Examples include general construction work areas, open excavations, high noise areas, vehicle access areas, and similar activities or limited access locations. These areas shall be clearly demarcated with physical barriers (fencing, cones, reinforced caution tape or rope) as necessary and posted with appropriate signage.

# 18 Decontamination

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(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. The SC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC. The SC must ensure that procedures are established for disposing of materials generated on the site.

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC should establish areas for eating, drinking, and smoking.

## 18.1 Contamination Prevention

Preventing or avoiding contamination of personnel, tools, and equipment will be considered in planning work activities at all field locations. Good contamination prevention and avoidance practices will assist in preventing worker exposure and result in a more efficient decontamination process. Procedures for contamination prevention and avoidance include the following:

- Do not walk through areas of obvious or known contamination;
- Do not directly handle or touch contaminated materials;
- Make sure there are no cuts or tears in PPE;
- Fasten all closures in suits and cover them with duct tape, if appropriate;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contamination, where possible;
- Do not eat or drink in contaminated work areas;
- Do not carry food, beverages, tobacco, or flame-producing equipment into contaminated work areas;
- Minimize the number of personnel and amount of equipment in contaminated areas to that necessary for accomplishing the work;
- Choose tools and equipment with nonporous exterior surfaces that can be easily cleaned and decontaminated;
- Cover monitoring and sampling equipment with clear plastic, leaving openings for the sampling ports, as necessary; and
- Minimize the amount of tools and equipment necessary in contaminated areas.

## 18.2 Personnel and Equipment Decontamination

Personnel exiting an EZ must ensure that they are not spreading potential contamination into clean areas or increasing their potential for ingesting or inhaling potential contaminants. Personal decontamination may range from removing outer gloves as exiting the EZ, to proceeding through an outer layer doffing station including a boot and glove wash and rinse, washing equipment, etc. Equipment that has come into contact with contaminated media must also be cleaned/decontaminated when it is brought out of the EZ.

## **18.3 Decontamination During Medical Emergencies**

Standard personnel decontamination practices will be followed whenever possible. For emergency life saving first aid and/or medical treatment, normal decontamination procedures may need to be abbreviated or omitted. In this situation, site personnel shall accompany contaminated victims to advise emergency response personnel on potential contamination present and proper decontamination procedures.

Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

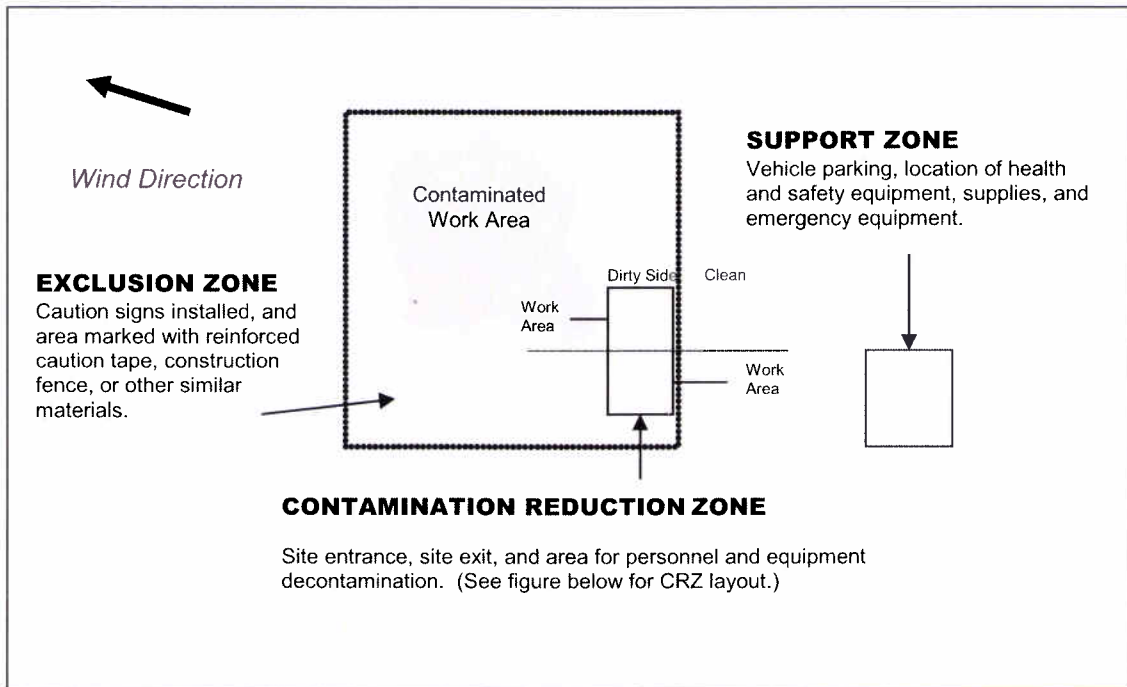
## **18.4 Waste Collection and Disposal**

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with the project plans.

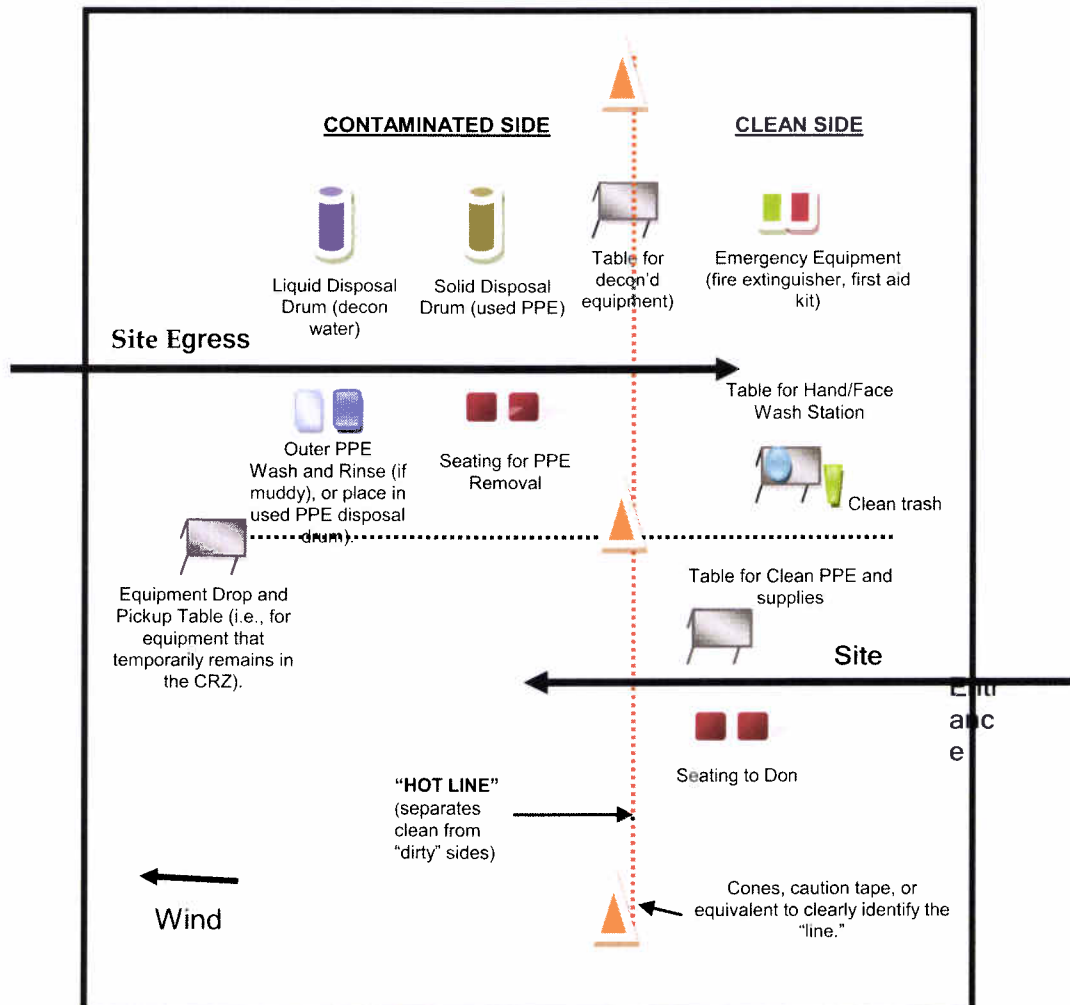
## **18.5 Diagram of Personnel-Decontamination Line**

The following figure illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC to accommodate task-specific requirements.

## Work Area - Set up appropriately based on wind direction



## Typical Contamination Reduction Zone



# 19 Emergency Response Plan

(Reference CH2M HILL SOP HSE-106, *Emergency Planning*)

## 19.1 Pre-Emergency Planning

The Emergency Response Coordinator (ERC), typically the SC or designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate. Pre-Emergency Planning activities performed by the ERC include:

- Review the facility emergency and contingency plans where applicable;
- Determine what onsite communication equipment is available (two-way radio, air horn);
- Determine what offsite communication equipment is needed (nearest telephone, cell phone);
- Confirm and post the "Emergency Contacts" page and route to the hospital located in this section in project trailer(s) and keep a copy in field vehicles along with evacuation routes and assembly areas. Communicate the information to onsite personnel and keep it updated;
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear;
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures;
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies;
- Inventory and check site emergency equipment, supplies, and potable water;
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases;
- Rehearse the emergency response plan before site activities begin. This may include a "tabletop" exercise or an actual drill depending on the nature and complexity of the project. Drills should take place periodically but no less than once a year;
- Brief new workers on the emergency response plan; and
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

## 19.2 Emergency Equipment and Supplies

The ERC shall ensure the following emergency equipment is on the site. Verify and update the locations of this equipment as needed. The equipment will be inspected in accordance with manufacturer's recommendations. The inspection shall be documented in a field logbook or similar means to be kept in the project files.

Emergency Equipment and Supplies	Location
20 (or two 10) class A,B,C fire extinguisher	Vehicle
First aid kit	Vehicle
Eye wash	Vehicle
Potable water	Vehicle
Bloodborne-pathogen kit	Vehicle
Additional equipment (specify): Cell phone	FTL

## 19.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Notify appropriate response personnel;
- Shut down CH2M HILL operations and evacuate the immediate work area;
- Account for personnel at the designated assembly area(s);
- Assess the need for site evacuation, and evacuate the site as warranted;
- Implement HSE-111, Incident Notification, Reporting and Investigation; and
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in the "Incident Notification, Reporting, and Investigation" section of this HSP.

## 19.4 Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing or heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify 911 or other appropriate emergency response authorities as listed in the "Emergency Contacts" page located in this section.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a CH2M HILL employee, the supervisor will call the occupational nurse at 1-866-893-2514 and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.
- Follow the Serious Incident Reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report using the HITS system on the VO or if not feasible, use the hard copy forms provided as an attachment to this HSP.
- Notify and submit reports to client as required in contract.

## 19.5 Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).

- The ERC will follow the incident reporting procedures in the “Incident Notification, Reporting and Investigation” section of this HSP.

## 19.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

## 19.7 Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop--seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area;
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers;
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding;
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands; and
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

## 19.8 Emergency Contacts

**24-hour CH2M HILL Injury Reporting– 1-866-893-2514**

**24-hour CH2M HILL Serious Incident Reporting Contact – 720-286-4911**

<b>Medical Emergency</b>  On-base #:301-744-4333 (if in restricted area, use red call boxes-no cell phone usage in restricted area!)  Off base - 911	<b>CH2M HILL- Medical Consultant</b>  WorkCare Dr. Peter Greaney M.D. 300 S. Harbor Blvd, Suite 600 Anaheim , CA 92805 800-455-6155/866-893-2514 714-978-7488
<b>Fire/Spill Emergency</b>  On-base #:301-744-4333 (if in restricted area, use red call boxes-no cell phone usage in restricted area!)  Off base - 911	<b>CH2M HILL Director – Health, Safety, Security &amp; Environment</b>  Andy Strickland/DEN (720) 480-0685 (cell) or (720) 286-2393 (office)
<b>Security &amp; Police</b>  On-base #:301-744-4333 (if in restricted area, use red call boxes-no cell phone usage in restricted area!)  Off base - 911	<b>CH2M HILL Responsible Health and Safety Manager (RHSM)</b>  Name: Mark Orman Phone: Wk 414847-0597 Cell: 414/712-4138
<b>Utilities Emergency Phone Numbers</b>  Contact Nick Carros, NSF – IH Phone 301/744-2263 Email: nicholas.carros@navy.mil	<b>CH2M HILL Human Resources Department</b>  Phone: Employee Connect toll-free number 1-877-586-4411 (U.S. and Canada)
<b>CH2M HILL Project Manager</b>  Name: Margaret Kasim Phone: 703-376-5154	<b>CH2M HILL Worker's Compensation:</b>  Contact Business Group HR dept. to have form completed or contact Jennifer Rindahl after hours: (720)891-5382
<b>CH2M HILL Safety Coordinator (SC)</b>  Name: TBD Phone:	<b>Media Inquiries Corporate Strategic Communications</b>  Name: John Corsi Phone: (720) 286-2087
<b>CH2M HILL Project Environmental Manager</b>  Name: Hope Wilson  Wk: 678/530-4226  Cell: 678/656-5411	<b>Automobile Accidents</b>  Rental: Jennifer Rindahl/DEN: 720-286-2449  CH2M HILL owned vehicle: Linda George/DEN: 720-286-2057
<b>Federal Express Dangerous Goods Shipping</b>  Phone: 800/238-5355	<b>CHEMTEL (hazardous material spills)</b>  <b>Phone: 800/255-3924</b>

Facility Alarms: Since CH2M HILL personnel will not always be working in close proximity to each other, hand signals, voice commands, air horns, and two-way radios will comprise the mechanisms to alert site personnel of an emergency.

All onsite contractors must read and sign the "Hazard Control Briefing for Environmental Division Visitors IHDI VNAV SURFAWARCEN", and attend the "Pre-construction Safety Briefing" from the Safety Department prior to commencing work.

Evacuation Assembly Area(s): To be determined by site safety coordinator at beginning of job.

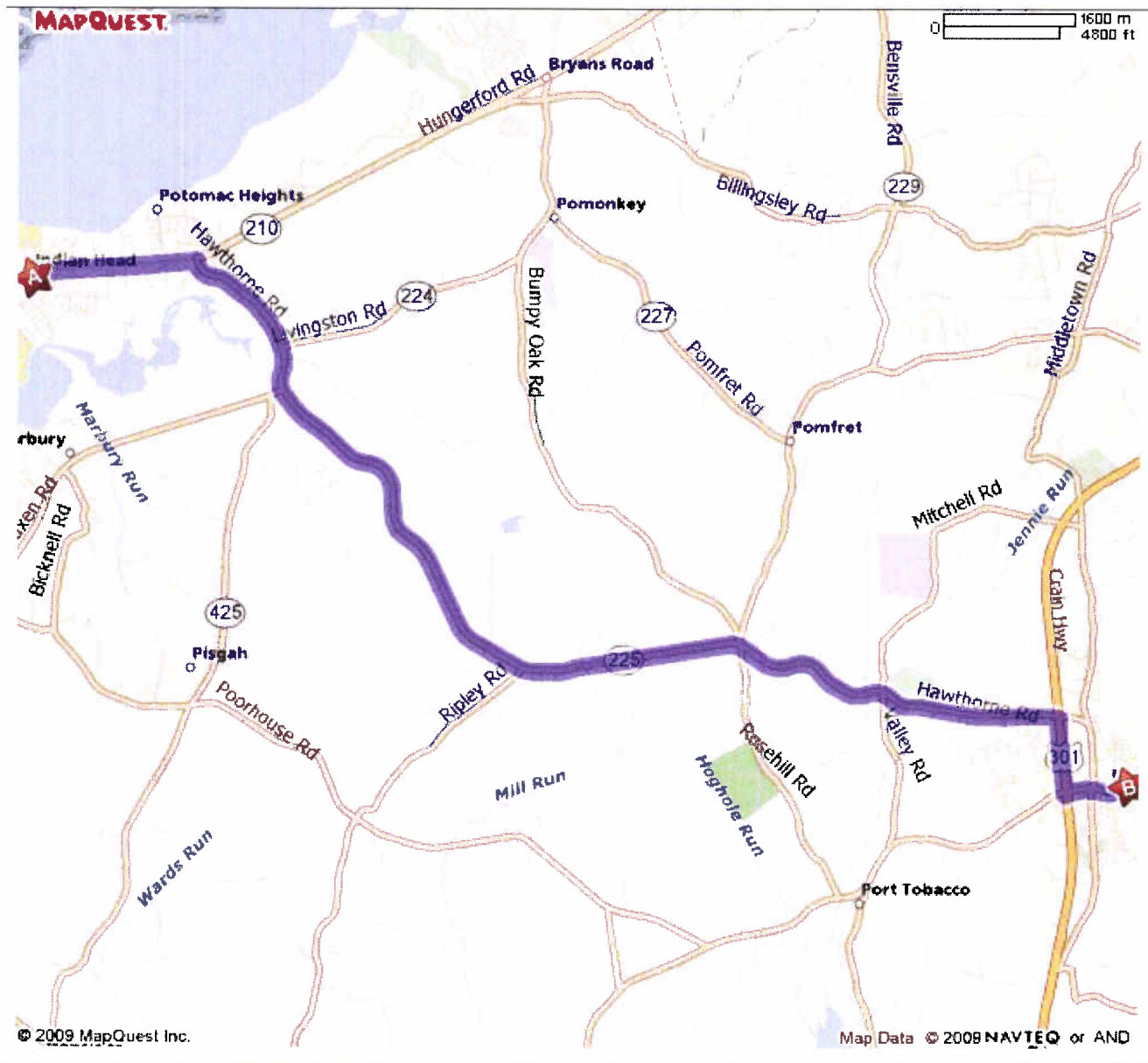
Facility/Site Evacuation Route(s): Evacuation procedures will be discussed prior to the initiation of any work at the site. Primary and secondary evacuation routes will be conveyed to site personnel before initiation of work. Evacuation routes from the site are dependent upon the location at which work is being performed and the circumstances under which an evacuation is required. Additionally, site location and meteorological conditions (i.e. wind speed and direction) will influence the designation of evacuation routes. As a result, assembly points will be selected, and will be proceeded to by field personnel in the event of an emergency by the most direct route possible without further endangering themselves.

## Directions to Local Hospital

### Local Hospital

Hospital Name/Address: Civista Medical Center  
701 E. Charles St., LaPlata, MD 20646

Hospital Phone #: 301-609-4000



Civista Medical Center, located at 701 East Charles Street, La Plata, MD

1. 0.0 Start on STRAUSS AV. N. Drive 0.9 miles
2. At 0.9 miles, drive onto HWY 210. Drive 0.7 miles
3. At 1.5 miles, TURN RIGHT on INDIAN HEAD LAPLATA RD. Drive 8.9 miles.
4. At 10.4 miles, drive onto HAWTHORNE DR. Drive 1.7 miles.
5. At 12.1 miles, TURN RIGHT on US 301. Drive 0.7 miles.
6. At 12.8 miles, TURN LEFT on CHARLES ST. Continue 0.6 miles to the hospital.

## 20 Spill Containment Procedures

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CH2M HILL and subcontractor personnel working at the project site shall be knowledgeable of the potential health, safety and environmental concerns associated with petroleum and other substances that could potentially be released at the project site.

The following is a list of criteria that must be addressed in CH2M HILL's or the subcontractor's plans in the event of a spill or release. In the event of a large quantity spill notify emergency services. Personnel discovering a spill shall (only if safe to do so):

- Stop or contain the spill immediately (if possible) or note source. Shut off the source (e.g., pump, treatment system) if possible. If unsafe conditions exist, then leave the area, call emergency services, inform nearby personnel, notify the site supervisors, and initiate incident reporting process. The SC shall be notified immediately;
- Extinguish sources of ignition (flames, sparks, hot surfaces, cigarettes);
- Clear personnel from the spill location and barricade the area;
- Use available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, recur, or spread;
- Use sorbent materials to control the spill at the source;
- Construct a temporary containment dike of sorbent materials, cinder blocks, bricks or other suitable materials to help contain the spill;
- Attempt to identify the character, exact source, amount, and extent of the released materials. Identification of the spilled material should be made as soon as possible so that the appropriate cleanup procedure can be identified;
- Assess possible hazards to human health or the environment as a result of the release, fire or explosion; and
- Follow incident notification, reporting, and investigation section of this plan.

# 21 Inspections

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## 21.1 Project Activity Self-Assessment Checklists

In addition to the hazard controls specified in this document, Project Activity Self-Assessment Checklists are contained as an attachment to this HSP. The Project-Activity Self-Assessment Checklists are based upon minimum regulatory compliance and some site-specific requirements may be more stringent. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. The self-assessment checklists, including documented corrective actions, shall be made part of the permanent project records and maintained by the SC.

The self-assessment checklists will also be used by the SC in evaluating the subcontractors and any client contractors' compliance on site.

The self-assessment checklists for the following tasks and exposures are required when the task or exposure is initiated and weekly thereafter while the task or exposure is taking place. The checklists shall be completed by the SC or other CH2M HILL representative and maintained in project files.

- Drilling
- Hand and Power Tools
- Manual lifting
- PPE
- Biological Prevention

## 21.2 Safe Behavior Observations

Safe Behavior Observations (SBOs) are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss.

The SC or designee shall perform at least one SBO each week for any field work performed by subcontractors or when there are at least two CH2M HILL personnel performing field work.

The SC or designee shall complete the SBO form (attached to this HSP) for the task/operation being observed and submit them weekly.

For Federal projects, SBOs may be submitted electronically by e-mailing them to the address, "CH2M HILL ES FED Safe Behavior Observations" when connected to the network or at

[CH2MHILLESFEDSafeBehaviorObservation@ch2m.com](mailto:CH2MHILLESFEDSafeBehaviorObservation@ch2m.com).

# 22 Incident Notification, Reporting, and Investigation

(Reference CH2M HILL SOP HSE-111, *Incident Notification, Reporting and Investigation*)

## 22.1 General Information

This section applies to the following:

- All injuries involving employees, third parties, or members of the public;
- Damage to property or equipment;
- Interruptions to work or public service (hitting a utility);
- Incidents which attract negative media coverage;
- Near misses;
- Spills, leaks, or regulatory violations; and
- Motor vehicle accidents.

Documentation, including incident reports, investigation, analysis and corrective measure taken, shall be kept by the SC and maintained onsite for the duration of the project.

## 22.2 Section Definitions

**Incident:** An incident is an event that causes or could have caused undesired consequences. An incident may be caused by natural forces, employees, subcontractors, or third parties in any location associated with CH2M HILL operations, including offices, warehouses, project sites, private property, or public spaces. Incidents include:

- Injury or illness to a CH2M HILL employee or subcontractor employee, or member of the public;
  - Property damage;
  - Spill or release;
  - Environmental requirement or permit violation;
  - A “near-miss”; or
  - Other (e.g., fire, explosion, bomb threat, workplace violence, threats)
- Accident:** an incident involving actual loss through injury, damage to assets, or environmental harm.

**Near Miss:** A near-miss occurs when an intervening factor prevented an injury or illness, property damage, spill or release, permit violation or other event from occurring. Examples of near-miss situations include: a hard hat or other personal protective equipment (PPE) prevented an injury; secondary containment or emergency shutoff prevented a spill; or an alert co-worker prevented an incident.

### **Serious Incident:**

A Serious Incident must be immediately reported to senior management includes:

- Work related death, or life threatening injury or illness of a CH2M HILL employee;
- subcontractor, or member of the public;
- Kidnap/missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than \$ 500,000 in damage; or

- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

## 22.3 Reporting Requirements

All employees and subcontractors' employees shall immediately report any incident (including "near misses," as defined in the section above) in which they are involved or witness to their supervisor.

The CH2M HILL or Subcontractor supervisor, upon receiving an incident report, shall inform his immediate superior and the CH2M HILL SC.

The SC shall immediately report the following information to the RHSM and PM by phone and e-mail:

- Project Name and Site Manager;
- Date and time of incident;
- Description of incident;
- Extent of known injuries or damage;
- Level of medical attention; and
- Preliminary root cause/corrective actions

The RHSM shall immediately inform the EM (or available alternate) of spills, potential environmental permit compliance, or any environmental situation that could result in a notice of violation from an agency.

The CH2M HILL team shall comply with all applicable statutory incident reporting requirements such as those to OSHA, the police, or state or Federal environmental agency.

## 22.4 HITS System and Incident Report Form

CH2M HILL maintains a HITS entry and/or Incident Report Form (IRF) for all work-related injuries and illnesses sustained by its employees in accordance with recordkeeping and insurance requirements. A HITS entry and/or IRF will also be maintained for other incidents (property damage, fire or explosion, spill, release, potential violation, and near misses) as part of our loss prevention and risk reduction initiative.

The SC shall complete an entry into the Hours and Incident Tracking System (HITS) database system located on CH2M HILL's Virtual Office (or if VO not available, use the hard copy Incident Report Form and Root Cause Analysis Form and forward it to the RHSM) within 24 hours and finalize those forms within 3 calendar days.

## 22.5 Injury Management/Return-to-Work (for US/Puerto Rico based CH2M HILL Staff Only)

(Reference CH2M HILL, SOP HSSE-124, Injury Management/Return-to-Work)

### 22.5.1 Background

The Injury Management Program has been established to provide orderly, effective and timely medical treatment and return-to-work transition for an employee who sustains a work-related injury or illness. It also provides guidance and assistance with obtaining appropriate treatment to aid recovery, keep supervisors informed of employee status, and to quickly report and investigate work-related injury/illnesses to prevent recurrence.

To implement the Injury Management/Return-to-Work Program successfully, supervisors and/or SC should:

- Ensure employees are informed of the Injury Management/Return-to-Work Program;
- Become familiar with the Notification Process (detailed below); and
- Post the Injury Management/Return-to-Work Notification Poster.

## 22.5.2 The Injury Management/Return-to-Work Notification Process:

- Employee informs their supervisor.
- Employee calls the Injury Management Program toll free number 1-866-893-2514 immediately and speaks with the Occupational Injury Nurse. This number is operable 24 hours per day, 7 days a week.
- Supervisor ensures employee immediately calls the Injury Management Program number. Supervisor makes the call with the injured worker or for the injured worker, if needed.
- Nurse assists employee with obtaining appropriate medical treatment, as necessary schedules clinic visit for employee (calls ahead, and assists with any necessary follow up treatment). The supervisor or SC accompanies the employee if a clinic visit is necessary to ensure that employees receive appropriate and timely care.
- Supervisor or SC completes the HITS entry or Incident Report Form immediately (within 24 hours) and forwards it to the Project Manager and RHSM.
- Nurse notifies appropriate CH2M HILL staff by e-mail (supervisor, Health & Safety, Human Resources, Workers' Compensation).
- Nurse communicates and coordinates with and for employee on treatment through recovery.
- Supervisor ensures suitable duties are identified and available for injured or ill workers who are determined to be medically fit to return to work on transitional duty (temporary and progressive).
- Supervisor ensures medical limitations prescribed (if any) by physician are followed until the worker is released to full duty.

## 22.6 Serious Incident Reporting Requirements

(Reference CH2M HILL SOP HSE-111, *Incident Reporting, Notification and Investigation*)

The serious incident reporting requirements ensures timely notification and allows for positive control over flow of information so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities. This standard notification process integrates Health, Safety, Security and Environment and Firm Wide Security Operations requirements for the consistent reporting of and managing of serious events throughout our operations.

### 22.6.1 Serious Incident Determination

The following are general criteria for determining whether an incident on CH2M HILL owned or managed facilities or program sites is considered serious and must be immediately reported up to Group President level through the reporting/notification process:

- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public;
- Kidnap or missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than \$ 500,000 in damage; or
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

## 22.6.2 Serious Incident Reporting

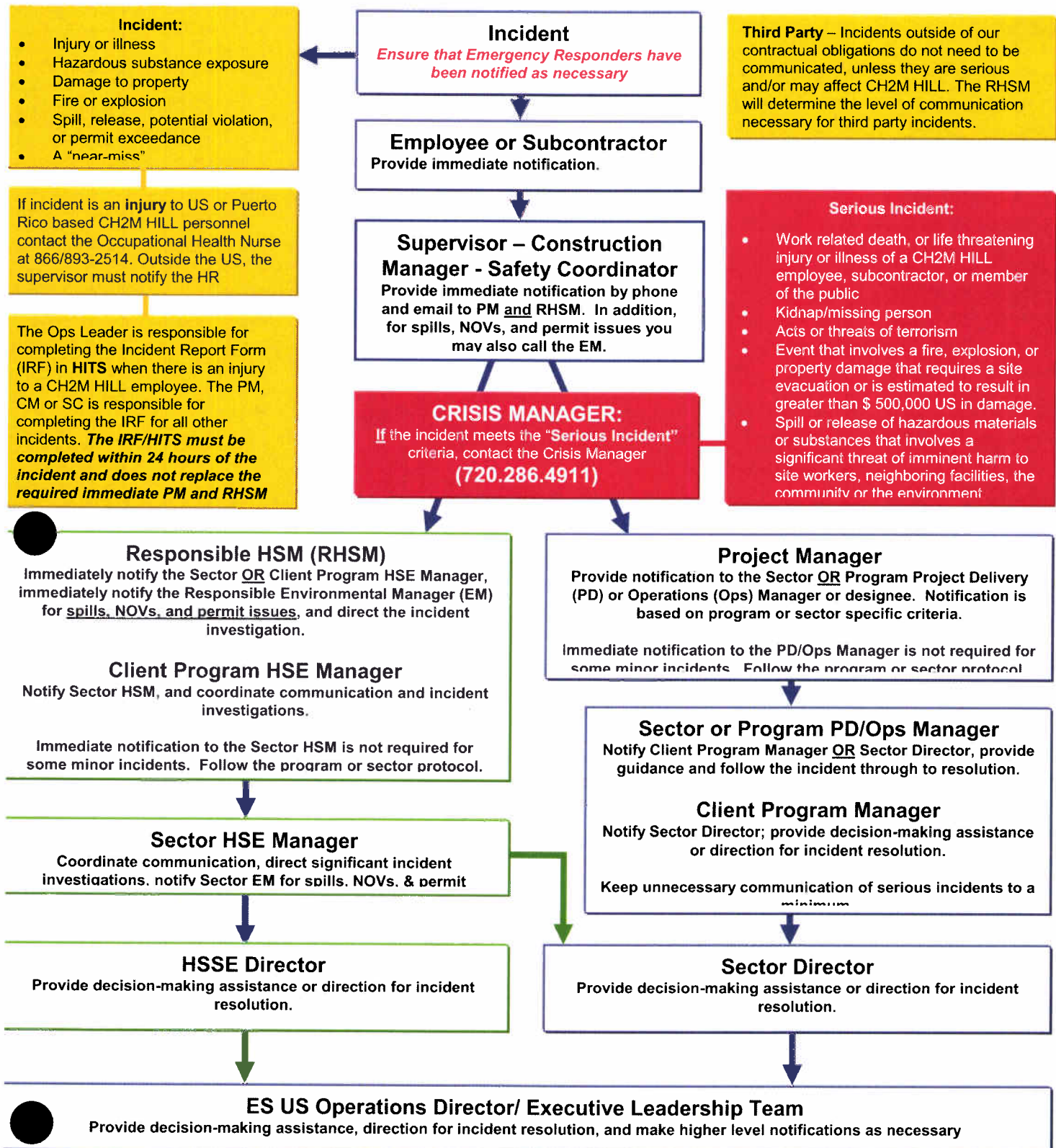
***If an incident meets the “Serious Incident” criteria, the Project Manager is to immediately contact the Crisis Manager at 720-286-4911, then follow the standard incident reporting procedure.***

For all serious incidents this standard reporting process is implemented immediately so as to ultimately achieve notification to the Business Group President within 2 hours of incident onset or discovery, and notification to appropriate corporate Crisis Management Support Team.

# ESBG US Operations Incident Reporting Flow Diagram

Direct Reporting Responsibility

Informational Reporting



**Post-emergency incident communications regarding serious incidents at a CH2M HILL office or project (regardless of the party involved) shall be considered sensitive in nature and must be controlled in a confidential manner.**

## 22.7 Incident Root Cause Analysis

The accident analysis is essential if all causes of the incident are to be identified for the correct remedial actions to be taken to prevent the same and similar type of incident from recurring. Root Cause Analysis (RCA) shall be completed for all recordable injuries, property damage incidents in excess of \$5000.00 (US), environmental permit violations, spills and releases which are required to be reported to regulatory agencies, and any other incident, including near misses where they RHSM or PM determines an RCA is appropriate. The RHSM/REM is responsible for ensuring it is completed and results entered in the incident report form in HITS. RCA's must be completed using a Team that includes, at least the RHSM or designee, the involved party(ies), a responsible operations representative (e.g. PM, construction manager, crew supervisor, etc.) and an independent management representative not associated with the incident.

The Root Cause Analysis Form must be completed for all Loss Incidents and Near Loss Incidents. This form must be submitted to the investigation team for review.

For minor losses or near losses, the information may be gathered by the supervisor or other personnel immediately following the loss. Based on the complexity of the situation, this information may be all that is necessary to enable the investigation team to analyze the loss, determine the root cause, and develop recommendations. More complex situations may require the investigation team to revisit the loss site or re-interview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videotapes of the scene and damaged equipment should be taken from all sides and from various distances. This point is especially important when the investigation team will not be able to review the loss scene.

The investigation team must follow the Root Cause Analysis Flow Chart (see Attachment 4 of the SOP) to assist in identifying the root cause(s) of a loss. Any loss may have one or more root causes and contributing factors. The root cause is the primary or immediate cause of the incident, while a contributing factor is a condition or event that contributes to the incident happening, but is not the primary cause of the incident. Root causes and contributing factors that relate to the person involved in the loss, his or her peers, or the supervisor should be referred to as "personal factors." Causes that pertain to the system within which the loss or injury occurred should be referred to as "job factors."

Personal factors include:

- Lack of skill or knowledge;
- Correct way takes more time and/or requires more effort;
- Short-cutting standard procedures is positively reinforced or tolerated; or
- Person thinks there is no personal benefit to always doing the job according to standards.

Job Factors include:

- Lack of or inadequate operational procedures or work standards;
- Inadequate communication of expectations regarding procedures or standards; or
- Inadequate tools or equipment.

The root cause(s) could be any one or a combination of these seven possibilities or some other uncontrollable factor. In the vast majority of losses, the root cause is very much related to one or more of these seven factors. Uncontrollable factors should be used rarely and only after a thorough review eliminates all seven other factors.

### 22.7.1 Corrective Actions

Include all corrective actions taken or those that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a timeframe for completion. Be sure the corrective actions address the causes.

Once the investigation report has been completed, the PM shall hold a review meeting to discuss the incident and provide recommendations. The responsible supervisors shall be assigned to carry out the recommendations, and shall inform the SC upon successful implementation of all recommended actions.

- Evaluation and follow-up of the IRF will be completed by the type of incident by the RHSM, EM, or FWSO.
- Incident investigations must be initiated and completed as soon as possible but no later than 72 hours after the incident.

## 23 Records and Reports

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An organized project filing system is essential for good documentation and recordkeeping. There are many benefits to an organized filing system:

- Other CH2M HILL employees can easily and quickly find documents;
- Records are readily available for review;
- Records may be needed during OSHA investigations, audits, or other legal matters;
- Records may be needed on short notice in case of an accident, illness or other emergency; and
- Systematic recordkeeping aids in overall project organization.

The project filing system shall be established at the beginning of the project and maintained throughout all phases of construction and archived in accordance with CH2M HILL's Records Retention Policy. The information contained in the filing system shall be updated regularly and/or as specified in this document. The PM and SC are responsible for collecting documentation, including subcontractor documentation, and maintaining a complete and organized filing system.

Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), MSDSs, exposure modeling results;
- Physical hazard exposure records include noise, ionizing radiation, non-ionizing radiation, vibration, and lasers exposure assessments and measurements;
- Respiratory fit test records;
- Training records;
- Incident reports, investigations and associated back-up information such as agency notifications, calculations, and corrective actions taken;
- Federal or state agency inspection records;
- Other Records:
  - Ergonomic evaluations;
  - HSE audits and assessments;
  - Project-specific HSE plans;
  - Confined space entry permits;
  - Equipment inspections;
  - Equipment maintenance;
  - Emergency equipment inspection records;
  - SBOs;
  - Self-assessment checklists
- The RHSM shall coordinate with the PM or designee to ensure that final project-specific HSE records described in this section, including negative exposure determinations, are maintained with the project files in accordance with the CH2M HILL records retention schedule, or forwarded to the Medical Surveillance Program Administrator, as appropriate. Records retention requirements are detailed in the Recordkeeping and Access to Records SOP, HSE-119.

# **CH2M HILL Health and Safety Plan**

## **Attachment 1**

### **Health and Safety Plan Employee Sign-off Form**

# EMPLOYEE SIGNOFF FORM

## Health and Safety Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

**Project Name:** Indian Head Site 47 Predesign Investigation

**Project Number:**[illegible]

# **CH2M HILL Health and Safety Plan**

## **Attachment 2**

### **Chemical Inventory/Register Form**

## CHEMICAL INVENTORY/REGISTER FORM

Refer to SOP HSE-107, Attachment 1, for instructions on completing this form.

Location:

HCC:

☐ Office

☐ Warehouse

☐ Laboratory

☐ Project:

Project No.:

Regulated Product	Location	Container labeled (✓if yes)	MSDS available (✓if yes)
HCL	Sample containers		
Nitric	Sample containers		
Sulferic	Sample containers		
Isopropanol			
Isobutylene			

MSDS for the listed products will be maintained at:

# **CH2M HILL Health and Safety Plan**

## **Attachment 3**

### **Chemical-Specific Training Form**

**CHEMICAL-SPECIFIC TRAINING FORM**

Refer to SOP HSE-107 Attachment 1 for instructions on completing this form.

Location:

Project # :

HCC:

Trainer:

**TRAINING PARTICIPANTS:**

NAME	SIGNATURE	NAME	SIGNATURE

**REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:**


The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

- ☐ Physical and health hazards
- ☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- ☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

# **CH2M HILL Health and Safety Plan**

## **Attachment 4**

### **Project Activity Self-Assessment Checklists/Permits/Forms**

Biological prevention

Drilling

Hand and Power Tools

Manual Lifting

Personal Protective Equipment

# HS&E Self-Assessment Checklist—Biological Prevention Measures

## HS&E Self-Assessment Checklist

Page 1 of 3

This checklist shall be used by Navy CLEAN personnel and shall be completed by each crew entering the work area at the frequency of one per day or otherwise specified in the project's Health and Safety Plan/Field Safety Instruction (HSP/FSI). The checklist should be completed prior to entry and at the end of the day to document that appropriate checks have been completed.

This checklist is to be used at locations where the possibility exists that contact with biological hazards is possible.

Site Safety Coordinator (SSC) will request any CH2M HILL subcontractor to take necessary precautions in eliminating the exposure to biological hazards, but shall not direct the means and methods.

Project Name: \_\_\_\_\_ Project No.: \_\_\_\_\_  
Location: \_\_\_\_\_ PM: \_\_\_\_\_  
Auditor: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

### SECTION 1 – PRE-ENTRY

Yes No N/A N/O

#### **SITE HAZARD EVALUATION**

1. Inform field members of hazards (types, symptoms)
2. Can work be completed without entering the work zone
3. Have controls been implemented where possible (clearing vegetation, spraying)
4. Has an inspection been made to identify nests, hives or areas where insects may concentrate
5. Will working at different time will reduce exposure

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### **SENSATIVITIES**

6. Does any staff have existing reactions to stings or bites
7. If yes to #6, is special required and medication available on site (epi-pen)
8. Has anyone with an existing condition briefed other team members about symptoms and first aid which may be required

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### **EMERGENCY RESPONSE**

9. Are first aid kits, along with tick removal kits, readily available to all staff
10. Does each member of the field staff have ability to communicate (phone, radios, and visual)
11. Are emergency contacts available (base emergency, local police, or local EMT)
12. If working in remote areas, is transport readily available (less than 5 minutes)
13. Have you planned an emergency exit from the site in the event of a swarm

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<b>SECTION 2 - PPE</b>		<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>N/O</b>
<b>SELECTION OF PPE</b>					
14. Will weather (heat, rain, ice) impact the safety of workers wearing protective suits		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Will visibility be limited to unacceptable levels if a hood is worn		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Will the use of equipment be difficult if a suit is worn		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Will heavy vegetation be encountered that could rip or damage a suit		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Will a Bug-Out suit or Tyvek suit be used by staff (if not, please give additional rationale in writing in Section 4)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>TYPE OF PPE USED OTHER THAN BUG-OUT OR TYVEK SUIT</b>					
19. Is staff wearing light-colored clothes		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Is staff wearing long sleeve shirts		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Are pant legs tucked into socks		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Are shirts tucked into pants		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Has tape been placed around sock/pant leg line and around waist		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Have hand and wrist areas been sealed		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Are hats being worn		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Have clothes been pre treated with Permethrin		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Has team member inspected coworker's suits or clothing to ensure no spaces exist for insects to penetrate		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<b>SECTION 3 – CHECKS AND DECONTAMINATION</b>		<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>N/O</b>
<b>DAILY CHECKS (TO BE COMPLETED DURING AND AT END OF DAY)</b>					
28. Were tick/insect checks performed during the day (if not, please provide reason in Section 4)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Was one unclothed tick check completed		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Were ticks found on the outerwear (if yes, please note the number in Section 4)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Were ticks found inside the Bug-Out, Tyvek, or personal clothing		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Were suits turned inside out and inspected prior to putting away		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Were showers taken by field staff immediately upon arrive from the field		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Were clothing placed in a garbage bag and sealed to prevent any insects from spreading		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. If ticks were found embedding in skin, were they properly removed and saved		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Have vehicles been inspected for ticks on a daily basis and before the vehicle is turned in		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>REPORTING</b>					
37. If a tick was found on your skin, could you tell where it entered so that it could be addressed		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. If a tick was found embedded, did you contact the PM, complete a HITS form and contact the Occupational Physician at 1-866-893-2514		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Did you contact field staff on the project to provide potential corrective measures		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. Did you follow the IM/RTW procedure to ensure you received the proper medical attention (if not, provide an explanation in Section 4)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



## Attachment 2: HSE Self-Assessment Checklist - Drilling

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's written safety plan.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to drilling hazards, 2) CH2M HILL staff are providing support function related to drilling activities, and/or 3) CH2M HILL oversight of a drilling subcontractor is required.

Safety Coordinator may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered being imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Project Name: \_\_\_\_\_ Project No.: \_\_\_\_\_

Location: \_\_\_\_\_ PM: \_\_\_\_\_

Auditor: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_

This specific checklist has been completed to:

- ☐ Evaluate CH2M HILL employee exposures to drilling hazards (complete Section 1).
- ☐ Evaluate CH2M HILL support functions related to drilling activities (complete Section 2)
- ☐ Evaluate a CH2M HILL subcontractor's compliance with drilling safety requirements (complete entire checklist).

Subcontractors Name: \_\_\_\_\_

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in SOP HSE-204.

### SECTION 1 - SAFE WORK PRACTICES - 5.1

	Yes	No	N/A	N/O
1. Personnel cleared during rig start-up, positioning and setup	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Personnel clear of rotating parts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Personnel not positioned under hoisted loads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Loose clothing and jewelry removed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Smoking is prohibited around drilling operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Personnel wearing appropriate personal protective equipment (PPE), per HSP or FSI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Personnel instructed not to approach equipment that has become electrically energized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### SECTION 2 - SUPPORT FUNCTIONS - 5.2

#### AQUIFER DESIGNATIONS (5.2.1)

8. Aquifer designations determined and BGEM consulted when required. ☐ Yes ☐ No ☐ N/A ☐ N/O

#### LOCATION OF UTILITIES (5.2.2)

9. Location of underground and overhead utilities and structures identified ☐ Yes ☐ No ☐ N/A ☐ N/O
10. Utility company contacted to de-energize/ground power lines due to clearance ☐ Yes ☐ No ☐ N/A ☐ N/O

### SUPPORT FUNCTIONS – 5.2 (Continued)

#### WASTE MANAGEMENT (5.2.3)

	Yes	No	N/A	N/O
11. Drill cuttings and purge water managed and disposed properly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Wastes generated evaluated for proper disposal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Appropriate decontamination procedures being followed, per project's written safety plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### DRILLING AT ORDNANCE EXPLOSIVES OR UNEXPLODED ORDNANCE SITES (5.2.4)

14. MEC plan prepared and approved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. MEC avoidance provided, routes and boundaries cleared and marked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Initial pilot hole established by UXO technician with hand auger	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Personnel remain inside cleared areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### SECTION 3 - DRILLING SAFETY REQUIREMENTS -5.3

#### GENERAL (5.3.1)

18. Only authorized personnel operating drill rigs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Daily safety briefing/meeting conducted with crew	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Daily inspection of drill rig and equipment conducted before use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Good housekeeping maintained on and around rig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### SAFETY EQUIPMENT (5.3.2)

22. Safety-toed boots, hardhats, safety glasses w/side shields, gloves and hearing protection worn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Drill rig equipped with fire extinguisher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Air monitoring instruments provided when required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Reflective/high visibility vests worn when required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. PPE for protection from chemical hazards worn if required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### BURIED UTILITY AND OVERHEAD CLEARANCE (5.3.3)

27. Location of underground utilities and structures identified, including third party locate <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. 3600 visual observation conducted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Hand digging, air knitting conducted to expose utilities before drilling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Safe clearance distance maintained from overhead power lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Power lines de-energized and grounded when safe distances cannot be maintained	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### DRILL RIG PLACEMENT (5.3.4)

32. Drilling pad established, when necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Drill rig leveled and stabilized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Additional precautions taken when drilling in restricted areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. In Karst topography use remote sensing or geologist review for sinkholes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### DRILL RIG TRAVEL (5.3.5)

36. Rig shut down and mast lowered and secured prior to rig movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Tools and equipment secured prior to rig movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Only personnel seated in cab wearing a seat belt are riding on rig during movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Backup alarm or spotter used when backing rig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. Spotter used when backing rig in tight or restricted areas or when low clearances exist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Safe clearance distance maintained while traveling under overhead power lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### EMERGENCY – CONTACT WITH OVERHEAD OR UNDERGROUND ELECTRICAL LINES (5.3.6)

42. Personnel understand emergency procedures in the event of contact with overhead or underground electrical lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------	--------------------------	--------------------------

#### DRILL RIG OPERATION (5.3.7)

43. Drill rig operated in accordance with operators' manual	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. Personnel clear while mast is being raised	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**SECTION 3 – DRILLING SAFETY REQUIREMENTS – 5.3 (CONTINUED)**

- |   |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 45. Kill switch clearly identified, operational, and in reach of the operator control station | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 46. All machine guards are in place   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 47. Rig ropes never wrapped around any part of the body                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 48. Pressurized lines and hoses secured to prevent whipping hazards                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 49. Drilling operation stopped during inclement weather                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 50. Air monitoring conducted per written safety plan for hazardous atmospheres                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 51. Rig gear boxes placed in neutral when operator not at controls                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 52. Operator shuts rig engine down prior to leaving the drill rig vicinity                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**DRILL RIG SITE CLOSURE (5.3.8)**

- |  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 53. Ground openings/holes filled or barricaded | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 54. Equipment and tools properly stored        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 55. All vehicles locked and keys removed       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**DRILL RIG MAINTENANCE (5.3.9)**

- |   |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 56. Rig properly maintained per drilling company's maintenance program and records on-site/available for review | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 57. Defective components repaired immediately   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 58. Lockout/tagout procedures used prior to maintenance   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 59. Cathead in clean, sound condition   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 60. Drill rig ropes in clean, sound condition   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 61. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 m or greater                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 62. Rig in neutral and augers stopped rotating before cleaning  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 63. Good housekeeping maintained on and around rig  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**FORMS/PERMITS AND CHECKLISTS (7.0)**

- |  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 64. Driller license/certification obtained   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 65. Well development/abandonment notifications and logs submitted and in project files | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 66. Groundwater withdrawal permit obtained where required                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 67. Dig permit obtained where required   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



This checklist shall be used by CH2M HILL personnel only and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees are exposed to hand and power tool hazards and/or (2) CH2M HILL provides oversight of subcontractor personnel who are exposed to hand and power tool hazards.

SC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of hand and power tool use nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Project Name: \_\_\_\_\_ Project No.: \_\_\_\_\_  
Location: \_\_\_\_\_ PM: \_\_\_\_\_  
Auditor: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_

This specific checklist has been completed to:

- ☐ Evaluate CH2M HILL employee exposure to hand and power tool hazards.  
☐ Evaluate a CH2M HILL subcontractor's compliance with hand and power tool requirements.  
Subcontractors Name: \_\_\_\_\_

Check "Yes" if an assessment item is complete/correct.

- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-210.

**SECTION 1****SAFE WORK PRACTICES (5.1)**

	<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
1. All tools operated according to manufacturer's instructions and design limitations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. All hand and power tools maintained in a safe condition and inspected and tested before use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Defective tools are tagged and removed from service until repaired.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. PPE is selected and used according to tool-specific hazards anticipated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Power tools are not carried or lowered by their cord or hose.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Safety guards remain installed or are promptly replaced after repair.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Tools are stored properly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Cordless tools and recharging units both conform to electrical standards and specifications.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Tools used in explosive environments are rated for such use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Knife or blade hand tools are used with the proper precautions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Consider controls to avoid muscular skeletal, repetitive motion, and cumulative trauma stressors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**SECTION 2****Yes No N/A N/O****GENERAL (5.2.2)**

- |  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 13. PPE is selected and used according to tool-specific hazards anticipated.           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. Tools are tested daily to assure safety devices are operating properly.            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. Damaged tools are removed from service until repaired.                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. Power operated tools designed to accommodate guards have guards installed.         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17. Rotating or moving parts on tools are properly guarded.                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. Machines designed for fixed locations are secured or anchored.                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. Floor and bench-mounted grinders are provided with properly positioned work rests. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. Guards are provided at point of operation, nip points, rotating parts, etc.        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21. Fluid used in hydraulic-powered tools is approved fire-resistant fluid.            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**ELECTRIC-POWERED TOOLS (5.2.3)**

- |   |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 22. Electric tools are approved double insulated or grounded and used according to SOP HSE-206.       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23. Electric cords are not used for hoisting or lowering tools.                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. Electric tools are used in damp/ wet locations are approved for such locations or GFCI installed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26. Portable, power-driven circular saws are equipped with proper guards.                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**ABRASIVE WHEEL TOOLS (5.2.4)**

- |  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 27. All employees using abrasive wheel tools are wearing eye protection.                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28. All grinding machines are supplied with sufficient power to maintain spindle speed.    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29. Abrasive wheels are closely inspected and ring-tested before use.                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30. Grinding wheels are properly installed.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31. Cup-type wheels for external grinding are protected by the proper guard or flanges.    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32. Portable abrasive wheels used for internal grinding are protected by safety flanges.   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33. Safety flanges are used only with wheels designed to fit the flanges.                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34. Safety guards on abrasive wheel tools are mounted properly and of sufficient strength. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**PNEUMATIC-POWERED TOOLS (5.2.5)**

- |  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 35. Tools are secured to hoses or whip by positive means to prevent disconnection.                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36. Safety clips or retainers are installed to prevent attachments being expelled.                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 37. Safety devices are installed on automatic fastener feed tools as required.                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38. Compressed air is not used for cleaning unless reduced to < 30 psi, with PPE, and guarded.       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39. Manufacturer's safe operating pressure for hoses, pipes, valves, etc. are not exceeded.          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 40. Hoses are not used for hoisting or lowering tools.   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 41. All hoses >1/2-inch diameter have safety device at source to reduce pressure upon hose failure.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 42. Airless spray guns have required safety devices installed.                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 43. Blast cleaning nozzles are equipped with operating valves, which are held open manually.         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 44. Supports are provided for mounting nozzles when not in use.                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 45. Air receiver drains, handholes, and manholes are easily accessible.                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 46. Air receivers are equipped with drainpipes and valves for removal of accumulated oil and water.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 47. Air receivers are completely drained at required intervals.                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 48. Air receivers are equipped with indicating pressure gauges.                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 49. Safety, indicating, and controlling devices are installed as required.                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 50. Safety valves are tested frequently and at regular intervals to assure good operating condition. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## **SECTION 2 (continued)**

### LIQUID FUEL-POWERED TOOLS (5.2.6)

51. Liquid fuel-powered tools are stopped when refueling, servicing, or maintaining.
52. Liquid fuels are stored, handled, and transported in accordance with SOP HSE-403
53. Liquid fuel-powered tools are used in confined spaces in accordance with SOP HSE-203.
54. Safe operating pressures of hoses, valves, pipes, filters, and other fittings are not exceeded.

### POWDER-ACTUATED TOOLS (5.2.7)

55. Only trained employee operates powder-actuated tools.
56. Powder-actuated tools are not loaded until just prior to intended firing time.
57. Tools are not pointed at any employee at any time.
58. Hands are kept clear of open barrel end.
59. Loaded tools are not left unattended.
60. Fasteners are not driven into very hard or brittle materials.
61. Fasteners are not driven into easily penetrated materials unless suitable backing is provided.
62. Fasteners are not driven into spalled areas.
63. Powder-actuated tools are not used in an explosive or flammable atmosphere.
64. All tools are used with correct shields, guards, or attachments recommended by manufacturer.

## JACKING TOOLS (5.2.8)

65. Rated capacities are legibly marked on jacks and not exceeded.
66. Jacks have a positive stop to prevent over-travel.
67. The base of jacks are blocked or cribbed to provide a firm foundation, when required.
68. Wood blocks are placed between the cap and load to prevent slippage, when required.
69. After load is raised, it is cribbed, blocked, or otherwise secured immediately.
70. Antifreeze is used when hydraulic jacks are exposed to freezing temperatures.
71. All jacks are properly lubricated.
72. Jacks are inspected as required.
73. Repair or replacement parts are examined for possible defects.
74. Jacks not working properly are removed from service and repaired or replaced.

### HAND TOOLS (5.2.9)

75. Wrenches are not used when jaws are sprung to the point of slippage.
76. Impact tools are kept free of mushroomed heads.
77. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool.

## CHAIN SAWS (5.2.10)

78. Chainsaw equipped with spark arrestor and fully functioning chain brake
79. Chainsaw operator's manual readily available
80. Fully stocked first aid kit and multipurpose fire extinguisher available
81. Appropriate personal protective equipment available and worn
82. Clothing free of loose edges that could become entangled in the saw
83. Chainsaw handles kept dry, clean, and free of oil or fuel mixture
84. Chainsaws held firmly with both hands and used right-handed
85. Operator standing to the left of the saw out of the plane of the chain
86. Saw used between the waist and mid-chest level
87. Full throttle maintained while cutting
88. Operator aware of position of guide bar tip, does not contact tip with anything being cut
89. Bumper spikes maintained as close to the object as possible
90. Operator aware of what is in the saw's downward path after the cut
91. No attempt to made to cut material that is larger than the guide bar of the saw
92. Cuts avoided that will cause chain to jam
93. Non-metallic wedges used to prevent compression cuts from jamming the blade
94. Bystanders and helpers kept at a safe distance from operation
95. Chainsaw not operated when fatigued
96. Fire extinguisher present when operating the chainsaw in forest or brushy areas

**Yes No N/A N/O**

[illegible]



## CH2MHILL

### 23.1 HSE Self-Assessment Checklist—Lifting

This checklist shall be used only by CH2M HILL personnel and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees perform manual lifting activities (office or projects), and/or (2) CH2M HILL provides oversight of a subcontractor performing manual lifting activities.

SC or Office Safety Coordinators/Committee members may consult with subcontractors (if applicable) when completing this checklist but shall not direct the means and methods of activities nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Conditions considered imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazardous area until corrected.

Complete the appropriate project or office information:

<b>Project Information</b>					
Project Name: _____		Project No.: _____			
Location: _____		PM: _____			
Auditor: _____	Title: _____	Date: _____			
<b>Office Information</b>					
Office Location: _____		Date: _____			
Auditor: _____		Title: _____			
This specific checklist has been completed to:					
<input type="checkbox"/> Evaluate CH2M HILL employee manual lifting activities.					
<input type="checkbox"/> Evaluate a CH2M HILL subcontractor's manual lifting activities.					
Subcontractor Name: _____					
<ul style="list-style-type: none"><li>• Check "Yes" if an assessment item is complete/correct.</li><li>• Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor.</li><li>• Check "N/A" if an item is not applicable.</li><li>• Check "N/O" if an item is applicable but was not observed during the assessment.</li></ul>					
Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-112.					
<b>Planning Activities</b>		<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>N/O</b>
1.	Efforts have been made to inquire about receiving equipment or supplies in containers weighting less than 50 pounds (23 kilograms).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	Equipment or supplies are being delivered as close as possible to their use point.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	Heavy equipment or supplies are being stored off the ground and no lower than knee height.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	Adequate space has been provided to access and lift equipment or supplies without reaching or twisting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Safe Work Practices (5.1)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
5.	Tasks or activities have been modified to reduce or minimize manual lifting.	O	O	O	O
6.	All employees performing manual lifting have received training on how to lift safely.	O	O	O	O
7.	Manual lifting control measures are evaluated during assessments.	O	O	O	O
8.	Manual lifting incidents are reviewed as part of the HSE Program reviews.	O	O	O	O
9.	Manual lifting incidents are reviewed as part of the HSE Program reviews.	O	O	O	O
Office Environments (5.1.1)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
10.	Employees have received lifting training.	O	O	O	O
11.	Mechanical devices are readily available to employees handling equipment or supplies weighing more than 40 pounds (18 kilograms).	O	O	O	O
Field Projects (5.1.2)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
12.	All manual lifting tasks or activities have been addressed in the written site safety plan.	O	O	O	O
13.	Employees have received safe lifting training as required by the written site safety plan.	O	O	O	O
Mechanical Lifting (5.2)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
14.	Hand trucks and trolleys are visually inspected before use.	O	O	O	O
15.	Hand trucks and trolleys do not have any broken or damaged parts.	O	O	O	O
16.	Hand truck and trolley paths are free of uneven surfaces, water, oil, or cracks and holes.	O	O	O	O
17.	Loads carried by hand trucks are balanced and sturdy.	O	O	O	O
18.	Hand trucks or dollies are being pushed when on level ground.	O	O	O	O
19.	When going up or down a slope using a hand truck or trolley, the load is downslope of the person.	O	O	O	O
20.	Employees using hand trucks or dollies are moving slowly and cautiously.	O	O	O	O
21.	Employees using hand trucks or trolleys are able to see over the load.	O	O	O	O
Assisted Lifting (5.3)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
22.	Personnel are not performing manual lifting beyond their physical capabilities.	O	O	O	O
23.	Loads are evenly distributed when being handled by multiple people.	O	O	O	O
Manual Lifting (5.4)		<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
24.	Before the lift, the load and path was assessed.	O	O	O	O
25.	Loads being lifted are free of sharp edges, slivers, or wet or greasy spots.	O	O	O	O
26.	Gloves are used for manual lifts of loads with sharp or splintered edges.	O	O	O	O
27.	Employees performing manual lifts use the proper lifting techniques.	O	O	O	O
28.	Special tools fabricated for lifting grates or manhole covers are used.	O	O	O	O



## HS&E Self-Assessment Checklist: PPERSONAL PROTECTIVE EQUIPMENT Page 1 of 3

This checklist shall be used by CH2M HILL personnel only and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where CH2M HILL employees are required to wear PPE or are required to perform oversight of a subcontractor using PPE or both.

CH2M HILL staff shall not direct the means and methods of subcontractor use of PPE nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies and CH2M HILL staff must carefully rely on their expertise. Conditions considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Project Name: \_\_\_\_\_ Project No.: \_\_\_\_\_

Location: \_\_\_\_\_ PM: \_\_\_\_\_

Auditor: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_

This specific checklist has been completed to (check only one of the boxes below):

- ☐ Evaluate CH2M HILL compliance with its PPE program (SOP HSE-117)  
☐ Evaluate a CH2M HILL subcontractor's compliance with its PPE program

Subcontractor's Name: \_\_\_\_\_

Check the appropriate box, as follows:

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-121.

### **SECTION 1**

#### **GENERAL**

1. Required PPE listed in HSP FSI or AHA.
2. PPE available for use by employees.
3. PPE cleaning supplies available for use.
4. PPE stored appropriately to prevent deformation or distortion.
5. PPE written certification has been completed.

**Yes No N/A N/O**

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### **EYEWEAR (Glasses/Goggles/Face Shields)**

- 6 Eyewear cleaning supplies available.
- 7 Safety glasses in good condition and lenses free of scratches.
- 8 Goggles adjustment strap not cracked or frayed, not deformed, or lenses not scratched.
9. Face shields in good condition, including adjustment band, and free of scratches or chips.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# CH2MHILL

## HS&E Self-Assessment Checklist: PERSONAL PROTECTIVE EQUIPMENT

Page 2 of 3

### SECTION 1 (Continued)

#### HEAD PROTECTION

	Yes	No	N/A	N/O
10. Hard hat bill and suspension attached as allowed by manufacturer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Shell is pliable, free of dents, cracks, nicks, or any damage due to impact.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Suspension maintained at 1.25 inches from inside of shell.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Suspension free of cuts or fraying, torn headband, adjustment strap workable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Electrical hard hat matched to hazard classification.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Dated to determine whether within manufacturer's allowable 5-year use time period.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### HAND PROTECTION

16. Available in sizes matched to employee.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Gloves free of rips tears, abrasions, or holes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Matched to manufacturer's specification for chemicals used onsite.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Electrical gloves matched to hazard and periodically inspected for insulating rating.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### BODY PROTECTION

21. Available in sizes matched to employee.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Vapor-tight fully encapsulated suits tested at required periodic intervals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Flame-resistant clothing matched to electrical hazard and arc flash rating.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Welding gear matched to degree of hazard and free of cuts, tears or burn holes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Flotation gear available for work near or on water and in good condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### HOT AND COLD BODY PROTECTION

27. Cooling gear available based on degree of heat stress hazard.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Cooling gear in operable, clean, and sanitary condition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Cold-weather gear provided based on needs assessment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Cold-weather gear available in sizes to match employees.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Cold-weather gear is in free of tears, rips, or holes and in maintained in a clean condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### TRAINING

32. Initial PPE training completed by employees.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Training conducted when new types or styles of PPE are issued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. PPE selection, use, and maintenance reviewed at daily safety briefings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Complete this section for all items checked "No" in Section 1. Deficient items must be corrected in a timely manner.

Auditor: \_\_\_\_\_ Project Manager: \_\_\_\_\_

# **CH2M HILL Health and Safety Plan**

## **Attachment 5**

### **Key Target Zero Program Elements**

**(blank forms for field use)**

**Activity Hazard Analysis Template**

**Pre-Task Safety Plans**

**Safe Behavior Observation**

**Incident Report and Investigation**

**(use electronic form when possible)**

[HITS](#)

**Lessons Learned Template**

## ACTIVITY HAZARD ANALYSIS

<b>Activity:</b>	<b>Date:</b>
<b>Description of the work:</b>	<b>Project Name:</b>
	<b>Site Supervisor:</b>
	<b>Site Safety Officer:</b>
	<b>Review for latest use: Before the job is performed</b>

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)

## ACTIVITY HAZARD ANALYSIS

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)

<b>Equipment to be used</b> (List equipment to be used in the work activity)	<b>Inspection Requirements</b> (List inspection requirements for the work activity)	<b>Training Requirements</b> (List training requirements including hazard communication)

# ACTIVITY HAZARD ANALYSIS

PRINT NAME

SIGNATURE

Supervisor Name: \_\_\_\_\_

\_\_\_\_\_

Date/Time: \_\_\_\_\_

Safety Officer Name: \_\_\_\_\_

\_\_\_\_\_

Date/Time: \_\_\_\_\_

Employee Name(s): \_\_\_\_\_

\_\_\_\_\_

Date/Time: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Date/Time: \_\_\_\_\_

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Date/Time: \_\_\_\_\_

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Date/Time: \_\_\_\_\_

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Date/Time: \_\_\_\_\_

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Date/Time: \_\_\_\_\_

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Date/Time: \_\_\_\_\_

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\_\_\_\_\_

Date/Time: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Date/Time: \_\_\_\_\_

# CH2MHILL

## Pre-Task Safety Plan (PTSP) and Safety Meeting Sign-in Sheet

Project: \_\_\_\_\_ Location: \_\_\_\_\_ Date: \_\_\_\_\_  
Supervisor: \_\_\_\_\_ Job Activity: \_\_\_\_\_

Attendees:	Print Name	Sign Name

List Tasks and verify that applicable AHAs have been reviewed:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

<input type="checkbox"/> Chemical burns/contact	<input type="checkbox"/> Trench, excavations, cave-ins	<input type="checkbox"/> Ergonomics
<input type="checkbox"/> Pressurized lines/equipment	<input type="checkbox"/> Overexertion	<input type="checkbox"/> Chemical splash
<input type="checkbox"/> Thermal burns	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Poisonous plants/insects
<input type="checkbox"/> Electrical	<input type="checkbox"/> Cuts/abrasions	<input type="checkbox"/> Eye hazards/flying projectile
<input type="checkbox"/> Weather conditions	<input type="checkbox"/> Spills	<input type="checkbox"/> Inhalation hazard
<input type="checkbox"/> Heights/fall > 6 feet	<input type="checkbox"/> Overhead Electrical hazards	<input type="checkbox"/> Heat/cold stress
<input type="checkbox"/> Noise	<input type="checkbox"/> Elevated loads	<input type="checkbox"/> Water/drowning hazard
<input type="checkbox"/> Explosion/fire	<input type="checkbox"/> Slips, trip and falls	<input type="checkbox"/> Heavy equipment
<input type="checkbox"/> Radiation	<input type="checkbox"/> Manual lifting	<input type="checkbox"/> Aerial lifts/platforms
<input type="checkbox"/> Confined space entry	<input type="checkbox"/> Welding/cutting	<input type="checkbox"/> Demolition
<input type="checkbox"/> Underground Utilities	<input type="checkbox"/> Security	<input type="checkbox"/> Poor communications

Other Potential Hazards (Describe):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Hazard Control Measures (Check All That Apply):

<b>PPE</b> <input type="checkbox"/> Thermal/lined <input type="checkbox"/> Eye <input type="checkbox"/> Dermal/hand <input type="checkbox"/> Hearing <input type="checkbox"/> Respiratory <input type="checkbox"/> Reflective vests <input type="checkbox"/> Flotation device <input type="checkbox"/> Hard Hat	<b>Protective Systems</b> <input type="checkbox"/> Sloping <input type="checkbox"/> Shoring <input type="checkbox"/> Trench box <input type="checkbox"/> Barricades <input type="checkbox"/> Competent person <input type="checkbox"/> Locate buried utilities <input type="checkbox"/> Daily inspections <input type="checkbox"/> Entry Permits/notification	<b>Fire Protection</b> <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> Fire watch <input type="checkbox"/> Non-spark tools <input type="checkbox"/> Grounding/bonding <input type="checkbox"/> Intrinsically safe equipment	<b>Electrical</b> <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Grounded <input type="checkbox"/> Panels covered <input type="checkbox"/> GFCI/extension cords <input type="checkbox"/> Power tools/cord inspected <input type="checkbox"/> Overhead line clearance <input type="checkbox"/> Underground utils ID'd
<b>Fall Protection</b> <input type="checkbox"/> Harness/lanyards <input type="checkbox"/> Adequate anchorage <input type="checkbox"/> Guardrail system <input type="checkbox"/> Covered opening <input type="checkbox"/> Fixed barricades <input type="checkbox"/> Warning system	<b>Air Monitoring</b> <input type="checkbox"/> PID/FID <input type="checkbox"/> Detector tubes <input type="checkbox"/> Radiation <input type="checkbox"/> Personnel sampling <input type="checkbox"/> LEL/O2 <input type="checkbox"/> No visible dust <input type="checkbox"/> Other	<b>Proper Equipment</b> <input type="checkbox"/> Aerial lift/ladders/scaffolds <input type="checkbox"/> Forklift/heavy equipment <input type="checkbox"/> Backup alarms <input type="checkbox"/> Hand/power tools <input type="checkbox"/> Crane with current inspection <input type="checkbox"/> Proper rigging <input type="checkbox"/> Operator qualified	<b>Welding &amp; Cutting</b> <input type="checkbox"/> Cylinders secured/capped <input type="checkbox"/> Cylinders separated/upright <input type="checkbox"/> Flash-back arrestors <input type="checkbox"/> No cylinders in CSE <input type="checkbox"/> Flame retardant clothing <input type="checkbox"/> Appropriate goggles
<b>Confined Space Entry</b> <input type="checkbox"/> Isolation <input type="checkbox"/> Air monitoring <input type="checkbox"/> Trained personnel <input type="checkbox"/> Permit completed <input type="checkbox"/> Rescue	<b>Medical/ER</b> <input type="checkbox"/> First-aid kit <input type="checkbox"/> Eye wash <input type="checkbox"/> FA-CPR trained personnel <input type="checkbox"/> Route to hospital	<b>Heat/Cold Stress</b> <input type="checkbox"/> Work/rest regime <input type="checkbox"/> Rest area <input type="checkbox"/> Liquids available <input type="checkbox"/> Monitoring <input type="checkbox"/> Training	<b>Vehicle/Traffic</b> <input type="checkbox"/> Traffic control <input type="checkbox"/> Barricades <input type="checkbox"/> Flags <input type="checkbox"/> Signs
<b>Permits</b> <input type="checkbox"/> Hot work <input type="checkbox"/> Confined space <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Excavation <input type="checkbox"/> Demolition <input type="checkbox"/> Energized work	<b>Demolition</b> <input type="checkbox"/> Pre-demolition survey <input type="checkbox"/> Structure condition <input type="checkbox"/> Isolate area/utilities <input type="checkbox"/> Competent person <input type="checkbox"/> Hazmat present	<b>Inspections:</b> <input type="checkbox"/> Ladders/aerial lifts <input type="checkbox"/> Lanyards/harness <input type="checkbox"/> Scaffolds <input type="checkbox"/> Heavy equipment <input type="checkbox"/> Drill rigs/geoprobe rigs <input type="checkbox"/> Cranes and rigging <input type="checkbox"/> Utilities marked	<b>Training:</b> <input type="checkbox"/> Hazwaste (current) <input type="checkbox"/> Construction <input type="checkbox"/> Competent person <input type="checkbox"/> Task-specific <input type="checkbox"/> FA/CPR <input type="checkbox"/> Confined Space <input type="checkbox"/> Hazcom
<b>Underground Utilities</b> <input type="checkbox"/> Dig alert called <input type="checkbox"/> 3 <sup>rd</sup> Party locator <input type="checkbox"/> As-builts reviewed <input type="checkbox"/> Interview site staff <input type="checkbox"/> Client review <input type="checkbox"/> soft locate necessary?	<b>Incident Communications</b> <input type="checkbox"/> Work stops until cleared by TM/CM <input type="checkbox"/> Immediate calls to TM/CM <input type="checkbox"/> Client notification <input type="checkbox"/> 24 hour notification setup <input type="checkbox"/> Clear communications	<b>AHA' s</b> <input type="checkbox"/> reviewed and approved by HSM <input type="checkbox"/> on site and current <input type="checkbox"/> applicable for this day's work <input type="checkbox"/> Communication and incident processes included?	

Field Notes (including observations from prior day, etc.):

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Name (Print): \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

### Safe Behavior Observation Form

☐ Federal or ☐ Commercial Sector (check one)

☐ Construction or ☐ Consulting (check one)

Project Number:

Client/Program:

Project Name:

Observer:

Date:

 Position/Title of  
worker observed:

 Background Information/  
comments:

 Task/Observation  
Observed:

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			<b>Positive Observations/Safe Work Practices:</b>
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			<b>Questionable Activity/Unsafe Condition Observed:</b>
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			
Pace			<b>Observer's Corrective Actions/Comments:</b>
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			<b>Observed Worker's Corrective Actions/Comments:</b>
Other...			

 For ES Federal Sector projects please email completed forms to: [CH2M\\_HILL\\_ES\\_FED\\_Safe\\_Behavior\\_Observation](mailto:CH2M_HILL_ES_FED_Safe_Behavior_Observation)

 For ES Commercial Sector projects please email completed forms to: [CH2M\\_HILL\\_ES\\_COM\\_Safe\\_Behavior\\_Observation](mailto:CH2M_HILL_ES_COM_Safe_Behavior_Observation)

 For CNR ES staff please email completed forms to: [cnressafe@ch2m.com](mailto:cnressafe@ch2m.com)

## HITS Incident Report Hardcopy (Phase 1 – Initial Entry)

### Phase 1 – Initial Entry

#### Type of Incident (May select more than one)

- |  |   |                                    |
|--|---|------------------------------------|
| <input type="checkbox"/> Injury/Illness  | <input type="checkbox"/> Spill/Release      | <input type="checkbox"/> Near Miss |
| <input type="checkbox"/> Property Damage | <input type="checkbox"/> Environment/Permit | <input type="checkbox"/> Other     |

#### General Information Section

Preparer's Name: \_\_\_\_\_ Preparer's Phone Number: \_\_\_\_\_

Date of Incident: \_\_\_\_\_ Time of Incident: \_\_\_\_\_ AM / PM

What Business Group is accountable for this incident: \_\_\_\_\_

What Business Group SubGroup is accountable for this incident: \_\_\_\_\_

What CH2M HILL Company is accountable for this incident: \_\_\_\_\_

Where did the Incident occur?

- ☐ United States, Geographic Region: \_\_\_\_\_
- ☐ Canada, Province/Territory: \_\_\_\_\_
- ☐ International, County: \_\_\_\_\_

#### Location of Incident?

- ☐ Company Premises, CH2M HILL Office (use 3 letter office code if available): \_\_\_\_\_
- ☐ Project, Project name: \_\_\_\_\_
- ☐ In Transit
- Traveling from: \_\_\_\_\_
- Traveling to: \_\_\_\_\_
- ☐ At Home
- ☐ Other, Specify: \_\_\_\_\_

Describe the incident: \_\_\_\_\_

Describe how this event could have been prevented: \_\_\_\_\_

#### Provide Witness Information:

Name: _____	Phone: _____
Name: _____	Phone: _____
Name: _____	Phone: _____

#### Personnel Notified of Incident (Provide name, date and time):

CH2M HILL Personnel: \_\_\_\_\_

Client Personnel: \_\_\_\_\_

#### Additional Comments:

#### Injury/Illness Section [Complete only if Injury/Illness Incident type selected]

Who was injured?

- ☐ CH2M HILL Employee or CH2M HILL Temp Employee
- ☐ Subcontractor to CH2M HILL (Non-LLC Joint Venture Project)
- ☐ LLC Joint Venture Partner Employee
- ☐ LLC Joint Venture Project Subcontractor/Contractor
- ☐ Other

Name of Injured: \_\_\_\_\_ Job Title: \_\_\_\_\_

Employer Name: \_\_\_\_\_ Supervisor of Employee: \_\_\_\_\_

#### Complete for CH2M HILL Employee Injuries

Business Group of Injured Employee: \_\_\_\_\_

Has the employee called the Injury Management Administrator (1-866-893-2514)?

☐ Yes ☐ No ☐ Not Sure

Has the injured employee's supervisor been notified of this incident?

☐ Yes ☐ No ☐ Not Sure

**Complete for Non-CH2M HILL Employee Injuries**

Has the project safety coordinator been notified of this incident?

☐ Yes ☐ No ☐ Not Sure

Project Safety Coordinator: \_\_\_\_\_

Body Part Affected: \_\_\_\_\_

Injury/Illness (Result): \_\_\_\_\_

Describe treatment provided (if medication provided, identify whether over-the-counter or prescription): \_\_\_\_\_

Describe any work restriction prescribed (include dates and number of days): \_\_\_\_\_

**Physician/Health Care Provider Information**

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Was treatment provided away from the worksite?

☐ No  
☐ Yes

Facility Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ Phone Number: \_\_\_\_\_

Was injured treated in an emergency room?

☐ No ☐ Yes

Was injured hospitalized overnight as an in-patient?

☐ No ☐ Yes

**General Information Environmental Section [Complete only if Environment/Permit or Spill/Release Incident type selected]**

Who had control of the area during the incident?

- ☐ CH2M HILL, Company: \_\_\_\_\_  
☐ Subcontractor, Company: \_\_\_\_\_  
☐ Joint Venture Partner/Contractor/Subcontractor, Company: \_\_\_\_\_  
☐ Other, Company: \_\_\_\_\_  
Relationship to CH2M HILL: \_\_\_\_\_

**Property Damage Section [Complete only if Property Damage Incident type selected]**

Property Damaged: \_\_\_\_\_

Property Owner: \_\_\_\_\_

Damage Description: \_\_\_\_\_

Estimated US Dollar Amount: \_\_\_\_\_

**Spill or Release Section [Complete only if Spill/Release Incident type selected]**

Substance: \_\_\_\_\_

Estimated Quantity: \_\_\_\_\_

Did the spill/release move off the property?: \_\_\_\_\_

Spill/Release From: \_\_\_\_\_

Spill/Release To: \_\_\_\_\_

**Environment/Permit Section [Complete only if Environment/Permit Incident type selected]**

Describe Environmental or Permit Issue: \_\_\_\_\_

Permit Type: \_\_\_\_\_

Permitted Level or Criteria (e.g., discharge limit): \_\_\_\_\_

Permit Name and Number (e.g., NPDES No. ST1234): \_\_\_\_\_

Substance and Estimated Quantity: \_\_\_\_\_

Duration of Permit Exceedence: \_\_\_\_\_



# Lessons Learned

[Date] ESBG LL-11-xx

<b>Subject</b>	[Insert Descriptive Name of Lessons Learned]
<b>CH2M HILL Project?</b>	[Yes or No]
<b>Situation</b>	[Describe incident or situation that occurred in general terms. Try to be brief and avoid unnecessary details such as names of people or projects, business groups, divisions, dates, location, etc.]
<b>Lessons Learned (Recommendations and Comments)</b>	<ul style="list-style-type: none"><li>Bullet out any lessons learned, recommendations or other important "take away" information that would benefit others. Tie the recommendations to the incident or event, and avoid including information that is not directly tied to the event.</li></ul>
<b>Submitted By</b>	[Name/Office Location/Phone]
<b>Additional Information Contact</b>	[Name/Office Location/Phone]
<b>Keywords/Categories</b>	[Insert any keywords or incident categories that would aid in a search for this lessons learned]

Send completed Lessons Learned to the ESBG HSSE Director for posting and distribution. Please include a recommended distribution list.

---

**CH2M HILL Health and Safety Plan**  
**Attachment 6**

**Fact Sheets**  
**Tick Fact Sheet**  
**Vehicle Accident Guidance**  
**Heat Stress Monitoring**  
**Working Alone**

---

## Tick-Borne Pathogens — A Fact Sheet

Most of us have heard of Lyme disease or Rocky Mountain Spotted Fever (RMSF), but there are actually six notifiable tick-borne pathogens that present a significant field hazard. In some areas, these account for more than half of our serious field incidents. The following procedures should be applied during any field activity—even in places that are predominantly paved with bordering vegetation.

### Hazard Recognition

An important step in controlling tick related hazards is understanding how to identify ticks, their habitats, their geographical locations, and signs and symptoms of tick-borne illnesses.

### Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These include:

- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page.

### Tick Habitat

In eastern states, ticks are associated with deciduous forest and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture.

On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. For this region, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

### Illnesses and Signs & Symptoms

There are six notifiable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite—normally hours after attachment. The illnesses, presented in approximate order of most common to least, include:

- Lyme (bacteria)
- RMSF (bacteria)
- Ehrlichiosis (bacteria)
- STARI (Southern Tick-Associated Rash Illness) (bacteria)
- Tularemia (Rabbit Fever) (bacteria)
- Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs & symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. For Lyme disease, the bite area will sometimes resemble a target pattern. A variety of long-term symptoms may result if the illness is left untreated, including debilitating effects and death.



Deer Tick



From Left: adult female, adult male, nymph, and larvae Deer Tick (cm scale)



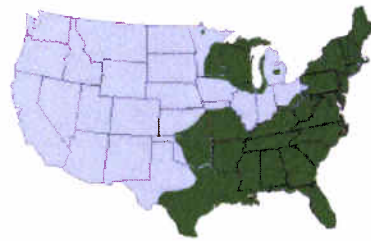
Lone Star Tick



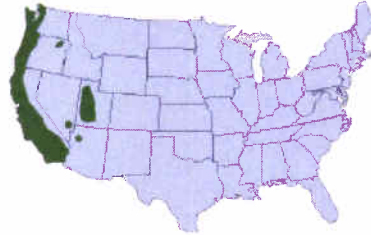
Dog Tick



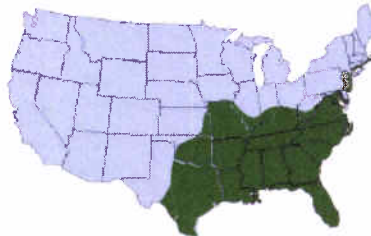
Rocky Mountain Wood Tick



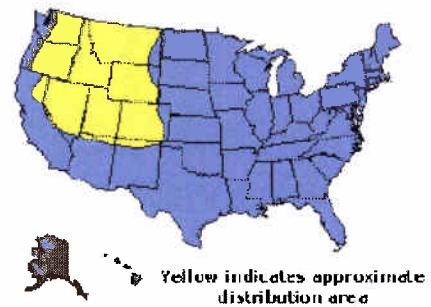
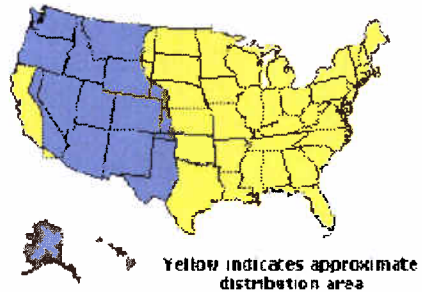
Distribution of Deer Tick (dark green)



Distribution of Pacific Deer Tick (dark green)



Distribution of Lone Star Tick (Green)



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## **Hazard Control**

The methods for controlling exposure to ticks include, in order of most- to least-preferred:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acaricide
- Personal protection through use of repellants and protective clothing
- Frequent tick inspections and proper hygiene

Vaccinations are not available and preventative antibiotic treatment after a bite is generally not recommended.

## **Avoidance and Reduction of Ticks**

To the extent practical, tick habitats should be avoided. In areas with significant tick infestation, consider stopping work and withdrawing from area until adequate tick population control can be achieved. Stopping and withdrawing should be considered as seriously as entering an area without proper energy control or with elevated airborne contaminants—tick-borne pathogens present risk of serious illness!

In areas where significant population density or infestation exists, tick reduction should be considered. Tick reduction can be achieved by disrupting tick habitats and/or direct population reduction through the use of tick-toxic pesticides (Damminix, Dursban, Sevin, etc.).

Habitat disruption may include only simple vegetative maintenance such as removing leaf litter and trimming grass and brush. Tick populations can be reduced by between 72 and 100 percent when leaf litter alone is removed. In more heavily infested areas, habitat disruption may include grubbing, tree trimming or removal, and pesticide application (Damminix, Dursban, Sevin, etc.). This approach is practical in smaller, localized areas or perimeter areas that require occasional access. Habitat controls are to be implemented with appropriate health and safety controls, in compliance with applicable environmental requirements, and may be best left to the property owner or tenant or to a licensed pesticide vendor. Caution should be exercised when using chemical repellents or pesticides in or around areas where environmental or industrial media samples will be collected for analysis.

## **Personal Protection**

After other prevention and controls are implemented, personal protection is still necessary to control exposure to ticks. Personal protection must include all of the following steps:

- So that ticks may be easily seen, wear light-colored clothing. Full-body New Tyvek (paper-like disposable coveralls) may also be used
- To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots
- Wear long-sleeved shirts, a hat, and high boots
- Apply DEET repellent to exposed skin or clothing per product label
- Apply permethrin repellent to the outside of boots and clothing before wearing, per product label
- Frequently check for ticks and remove from clothing
- At the end of the day, search your entire body for ticks (particularly groin, armpits, neck, and head) and shower
- To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves any time ticks are handled

Pregnant individuals and individuals using prescription medications should consult with their physician and/or pharmacists before using chemical repellents. Because human health effects may not be fully known, use of chemical repellents should be kept to a minimum frequency and quantity. Always follow

manufacturers' use instructions and precautions. Wash hands after handling, applying, or removing protective gear and clothing. Avoid situations such as hand-to-face contact, eating, drinking, and smoking when applying or using repellents.

Remove and wash clothes per repellent product label. Chemical repellents should not be used on infants and children.

Vaccinations are generally not available for tick-borne pathogens. Although production of the LYMErix™ Lyme disease vaccination has been ceased, vaccination may still be considered under specific circumstances and with concurrence from the consulting physician.

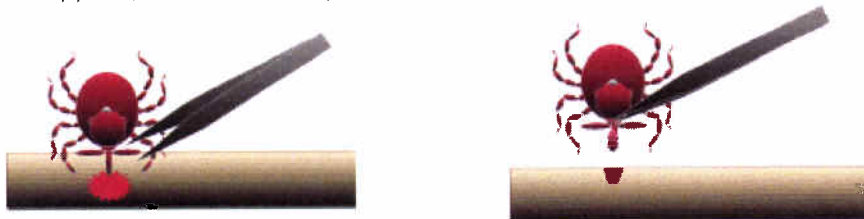
### Tick Check

A tick check should be performed after field survey before entering the field vehicle (you do not want to infest your field vehicle with ticks). Have your field partner check your back; the backs of your legs, arms, and neck; and your hairline. Shake off clothing as thorough as possible before entering the vehicle. Once the field day is complete, repeat this procedure and perform a thorough self check.

If a tick has embedded itself into the skin, remove the tick as described below.

### Tick Removal

1. Use the tick removal kit obtained through the CH2M HILL Milwaukee warehouse, or a fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.
2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with tweezers. Consult your healthcare provider if infection occurs.



3. Avoid squeezing, crushing or puncturing the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.
4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.
5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
6. Should you wish to save the tick for identification, place it in a plastic bag, with the date of the tick bite, and place in your freezer. It may be used at a later date to assist a physician with making an accurate diagnosis (if you become ill).

**Note:** Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

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**First-Aid and Medical Treatment**

Tick bites should always be treated with first-aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Individuals previously infected with Lyme disease does not confer immunity—re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

The employee should contact the Injury Management/Return To Work provider (IMRTW), WorkCare using the toll-free number 866-893-2514 to report the tick bite. WorkCare will follow-up with each CH2M Hill employee who reports a tick bite and is at risk of developing Lyme disease by monitoring for symptoms up to 45 days, and will refer the employee to a medical provider for evaluation and treatment as necessary.

## 2011 Vehicle Accident Guidance—ESBG

Remember that if you are **renting** a non-CH2M HILL owned vehicle (short-term rental) in the U.S., you should carry the [insurance card](#) from the state where your driver's license is issued.

If you operate a **fleet vehicle**, carry the [insurance card](#) where the vehicle is registered.

### **For ALL Vehicles if you are in an accident:**

1. If you are injured, call 911 for emergency medical treatment or 1-866-893-2514 to contact the CH2M HILL Occupational Nurse/Physician for minor injuries. If you feel you have not been injured, contact the RHSM for guidance on whether calling the CH2M HILL Occupation Nurse/Physician is applicable.
2. **Call the Police**--For any vehicle accident/damage, it is recommended that the local police (or site security/emergency services if working on a client site that provides such services) be called to determine if a report needs to be filed. In some instances, a report may not be required (during accident alerts, or in public parking lots). Document that the authorities were called and follow up with any guidance they give you. State requirements vary. If a report is filed, obtain a copy.
3. Notify Supervisor, (and PM/RHSM if working on a project site)
4. Complete a HITS report on the VO.

### **Additional Steps**

To report an auto accident, and before a claim can be taken by telephonic reporting, have available your name (the company name alone is no longer accepted, a driver's name must be provided even for fender benders), location of accident and your office address if different than the accident location, business group and project number. A claim cannot be taken without your name, address, business group and your project number. By location the state where the accident occurred, and which office you are aligned to, i.e., accident occurs in Idaho, but you are out of the Denver office. Advise the claim recorder the accident occurred in ID, but that your office location is Denver. This will assist the claim intake person in identifying location coding for the claims.

### **Auto accidents involve two different sections of an Auto policy:**

- 1) Liability to others due to Bodily Injury and Property Damage
  - 2) Physical Damage - Comprehensive and Collision - damage to the vehicle CH employee is driving
- CH2M Hill has Liability coverage for any auto - our policy will respond on either a primary or excess basis. Refer to the table below for additional notifications to make based on the type of accident experienced and type of vehicle being used.

### Liability - Bodily Injury or Property Damage to Others

Scenario	Which Coverage Responds	What to do if in an accident
CH2M Hill fleet, pool or project vehicle - long term lease - lower 48	CH2M Hill - Primary	Contact Broadspire (1-800-753-6737); Jennifer Rindahl/DEN (720-286-2449); Linda George/DEN (720-286-2057)
CH2M Hill fleet, pool or project vehicle - long term lease - Alaska (North Slope)	CH2M Hill - Primary	Contact Jennifer Rindahl/DEN (720-286-2449)
Client vehicle driven by CH2M Hill employee	Client's auto policy unless client has made CH2M Hill responsible for vehicle	Contact Broadspire (1-800-753-6737); Contact Jennifer Rindahl/DEN (720-286-2449); contact client;
Short term lease (30 days or less)	Rental car company if rented through Enterprise, Budget or Hertz; CH2M Hill excess	Contact Broadspire (1-800-753-6737); Contact local branch of rental car company where vehicle leased (ERAC includes 24 hour roadside assistance) and Jennifer Rindahl/DEN (720-286-2449)
Short term lease (30 days or less)	CH2M Hill - Primary if rented through company other than our national agreements; \$100,000 deductible	Contact Broadspire (1-800-753-6737); Contact rental car company and Jennifer Rindahl/DEN (720-286-2449)
Personal vehicle used on business	Employee's personal auto policy; CH2M Hill on an excess basis	Contact personal auto insurance company; contact Jennifer Rindahl/DEN (720-286-2449)

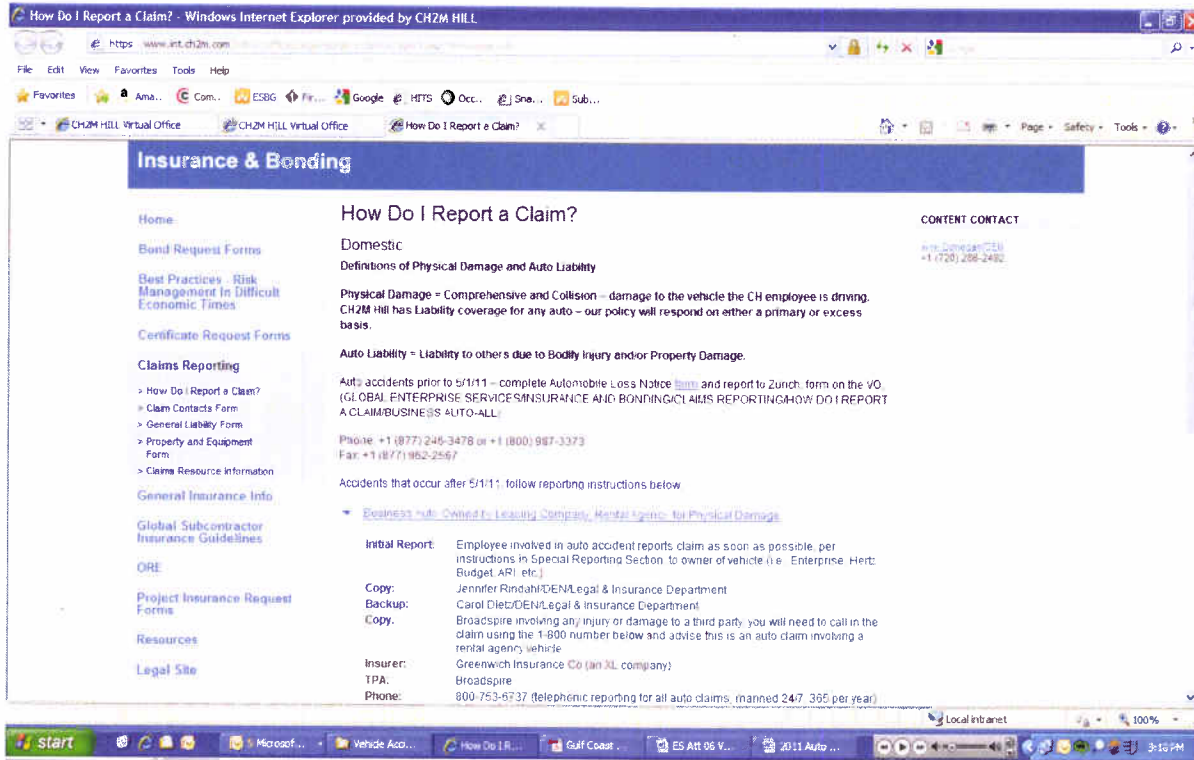
### Physical Damage - damage to vehicle CH employee was driving

Scenario	Which Coverage Responds	What to do if in an accident
CH2M Hill fleet, pool or project vehicle - long term lease - lower 48	CH2M Hill ONLY if vehicle is scheduled on policy - \$5,000 deductible	Contact Broadspire (1-800-753-6737); Jennifer Rindahl/DEN (720-286-2449); Linda George/DEN (720-286-2057)
CH2M Hill fleet, pool or project vehicle - long term lease - Alaska (North Slope)	CH2M Hill Equipment Schedule if scheduled on policy	Contact Jennifer Rindahl/DEN (720-286-2449)
CH2M Hill fleet, pool or project vehicle - long term lease	ARI if physical damage coverage purchased - \$500 deductible	Contact Jennifer Rindahl/DEN 720.286.2449; call ARI at 1-800-221-1645 give them Client Code and ARI fleet vehicle number; and notify Linda George/DEN - Fleet Coordinator - 720-286-2057
Client vehicle CH2M Hill Employee is driving	Client's auto policy unless client has made CH2M Hill contractually responsible for vehicle	Contact Jennifer Rindahl/DEN (720-286-2449); contact client; contact Broadspire (1-800-753-6737)
Short term lease (30 days or less) using corporate VISA	VISA if corporate credit card used and vehicle is not a pickup, truck, cargo van or used off-road	Contact VISA - 1-800-847-2911 or <a href="http://www.visa.com/eclaim">http://www.visa.com/eclaim</a>
Short term lease (30 days or less) through Enterprise (ERAC) and vehicle is used off-road and physical damage coverage included when vehicle leased	ERAC up to \$3,000 in damage; CH2M Hill's coverage is excess	Notify Rental Car Company; contact Jennifer Rindahl/DEN (720-286-2449) if damage over \$5,000
Short term lease (30 days or less) did <b>not</b> use corporate VISA	CH2M Hill - \$5,000 deductible (project responsibility)	Contact Broadspire (1-800-753-6737); Contact Jennifer Rindahl/DEN 720-286-2449; contact VISA - 1-800-847-2911 or <a href="http://www.visa.com/eclaim">http://www.visa.com/eclaim</a>
Personal vehicle used on business	CH will reimburse the amount of the deductible carried on the employee's policy up to \$500 whichever is less	Contact Jennifer Rindahl/DEN (720-286-2449); contact client; contact Broadspire (1-800-753-6737)

Details for reporting a claim on the CH2M Hill VO are accessed by going to the VO home page and clicking:  
GLOBAL ENTERPRISE SERVICES/INSURANCE & BONDING/CLAIMS REPORTING

HOW DO I REPORT A CLAIM TAB or access the following URL:

<https://www.int.ch2m.com/intrnl/voffice/corp/insurance/claims/report.asp?Menu=menu3h>



How Do I Report a Claim? - Windows Internet Explorer provided by CH2M HILL

https://www.int.ch2m.com

File Edit View Favorites Tools Help

CH2M HILL Virtual Office CH2M HILL Virtual Office How Do I Report a Claim?

**Insurance & Bonding**

Home: Bond Request Forms Best Practices - Risk Management In Difficult Economic Times Certificate Request Forms Claims Reporting

How Do I Report a Claim? Claim Contacts Form General Liability Form Property and Equipment Form Claims Resource Information

General Insurance Info Global Subcontractor Insurance Guidelines ORE Project Insurance Request Forms Resources Legal Site

**How Do I Report a Claim?**

Domestic

Definitions of Physical Damage and Auto Liability

Physical Damage = Comprehensive and Collision - damage to the vehicle the CH employee is driving. CH2M Hill has Liability coverage for any auto - our policy will respond on either a primary or excess basis.

Auto Liability = Liability to others due to Bodily Injury and/or Property Damage.

Auto accidents prior to 5/1/11 - complete Automobile Loss Notice [here](#) and report to Zurich form on the VO. (GLOBAL ENTERPRISE SERVICES INSURANCE AND BONDING) CLAIMS REPORTING HOW DO I REPORT A CLAIM/BUSINESS AUTO-ALL

Phone: +1 (877) 246-3478 or +1 (800) 987-3373  
Fax: +1 (877) 962-2567

Accidents that occur after 5/1/11, follow reporting instructions below

Business Auto: Owned by: Leasing Company, Rental Agency, for Physical Damage

**Initial Report:** Employee involved in auto accident reports claim as soon as possible, per instructions in Special Reporting Section, to owner of vehicle (i.e. Enterprise, Hertz, Budget, ARI, etc.)

**Copy:** Jennifer Rindahl/DEN Legal & Insurance Department

**Backup:** Carol Dietz/DEN Legal & Insurance Department

**Copy:** Broadspire involving any injury or damage to a third party, you will need to call in the claim using the 1-800 number below and advise this is an auto claim involving a rental agency vehicle

**Insurer:** Greenwich Insurance Co (an XL company)

**TPA:** Broadspire

**Phone:** 800-763-6737 (telephonic reporting for all auto claims, manned 24/7, 395 per year)

Local Intranet 100%

start Microsoft... Vehicle Acc... How Do I R... Gulf Coast... ES Att 96 V... 2011 Auto... 3:15 PM

### **For Personally Owned Vehicles (POVs):**

CH2M HILL does not provide auto insurance for POVs, it is responsibility of the owner. If you are in a vehicle accident conducting company business, contact the police as above, supervisor, and 911 or CH2M HILL's occupational nurse/physician as stated above. Complete a HITS report. Contact Jennifer Rindahl/DEN for assistance for meeting personal insurance deductibles (up to \$500) with proof of insurance and deductible.

If using your POV for extended project use, notify the PM to make sure a rental car is not needed. Check your insurance policy for guidance on using the POV for business use.

### **Additional Resources:**

[Claims Resource Manual](#)



### HEAT STRESS PHYSIOLOGICAL MONITORING FORM

Project

Company

1. Take and record measurement of temperature and pulse at the following times:
  - a. before beginning shift
  - b. at each break
  - c. at the end of the day
2. Shorten the work cycle by one third if measurements exceed:
 

Pulse – 110 beats per minute  
 Temperature – 99.6° F/37.6° C
3. Never continue work if your body temperature is more than 100.4° F/38° C, or if you are experiencing sudden and severe fatigue, nausea, dizziness, or lightheadedness.

Employee: \_\_\_\_\_

Date: \_\_\_\_\_ Describe action taken below if measurements are exceeded:

Time

Temp

Pulse

Employee: \_\_\_\_\_

Date: \_\_\_\_\_ Describe action taken below if measurements are exceeded:

Time

Temp

Pulse

Employee: \_\_\_\_\_

Date: \_\_\_\_\_ Describe action taken below if measurements are exceeded:

Time

Temp

Pulse

**WORKING ALONE PROTOCOL  
CALL – IN CONTACT FORM**

Date of site work: \_\_\_\_\_ Expected start time: \_\_\_\_\_  
Name of CH2M HILL employee in the field: \_\_\_\_\_  
Name of CH2M HILL employee responsible to receive contact: \_\_\_\_\_  
Client Emergency Contact (if any): \_\_\_\_\_  
CH2M HILL employee's contact numbers:  
    Radio # \_\_\_\_\_  
    Cell Phone # \_\_\_\_\_  
Address and Location of work: \_\_\_\_\_  
Directions/Map: \_\_\_\_\_

Planned Activity: \_\_\_\_\_  
Specified Frequency and time for call in: \_\_\_\_\_

Time

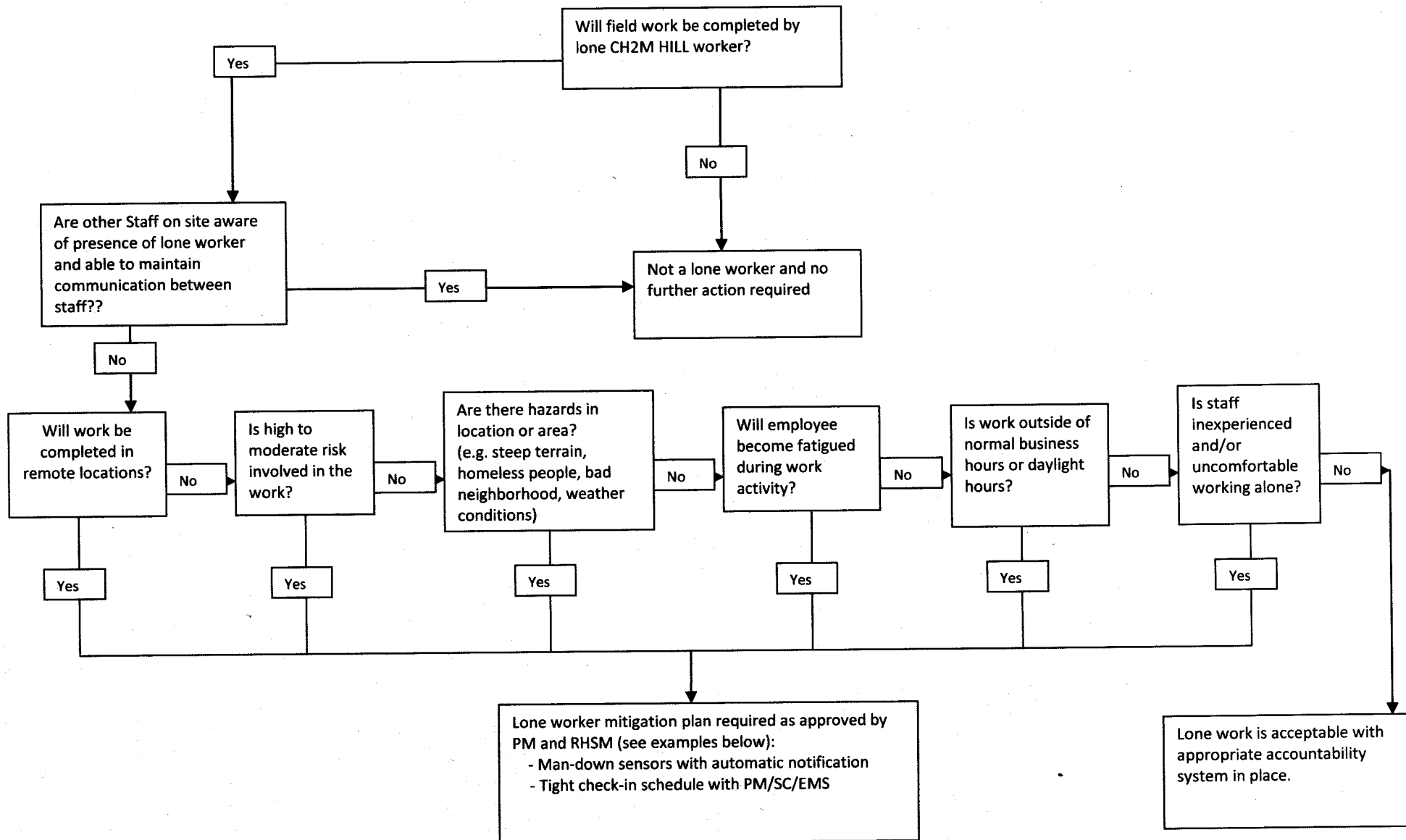
Verified

Location

If lone worker fails to call in at specified frequency/time:

- 1) Call worker's radio and cell to determine if an emergency exists.
- 2) If no reply, immediately call Client security/emergency service if there is one at the site.
- 3) If there is no client security call Emergency Services (911). Inform the dispatcher there is a lone worker that cannot be contacted and there may be an emergency on site. Provide the lone worker's name, their last known location, and your contact information.
- 4) After Emergency Services have been contacted, call the other emergency contacts, Project Manager, and Responsible Health and Safety Manager.

## Lone Worker Protocol



# **CH2M HILL HEALTH AND SAFETY PLAN**

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## **Attachment 7**

### **Observed Hazard Form**

**OBSERVED HAZARD FORM**Name/Company of Observer (*optional*):

Date reported: \_\_\_\_\_

Time reported: \_\_\_\_\_

Contractor/s performing unsafe act or creating unsafe condition:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Unsafe Act or Condition:

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Location of Unsafe Act or Condition:

Name of CH2M HILL Representative:

Corrective Actions Taken:

Date: \_\_\_\_\_

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Project Safety Committee Evaluation:

Date: \_\_\_\_\_

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# **CH2M HILL HEALTH AND SAFETY PLAN**

## **Attachment 8**

### **Stop Work Order Form**

# Stop Work Order

**REPORT PREPARED BY:**

Name:	Title:	Signature:	Date:

**ISSUE OF NONPERFORMANCE:**

Description:	Date of Nonperformance:

**SUBCONTRACTOR SIGNATURE OF NOTIFICATION:**

Name:	Title:	Signature:	Date:

*\* Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.\* Work may not resume until authorization is granted by CH2M HILL Constructors, Inc. Representative,*

**SUBCONTRACTOR'S CORRECTIVE ACTION**

Description:	Date of Nonperformance:

**SUBCONTRACTOR SIGNATURE OF CORRECTION**

Name:	Title:	Signature:	Date:

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# **CH2M HILL HEALTH AND SAFETY PLAN**

## **Attachment 9**

### **Agency Inspection Target Zero Bulletin**

## TARGET ZERO Bulletin

**Subject: HSSE Agency Inspections (OSHA, EPA, DOT, State Health Department)**

### **Do you know what YOU would do if an agency inspector arrived at your site unannounced?**

Recently, a State Occupational Safety and Health Administration (OSHA) inspector made an unannounced visit to one of our Federal project sites. OSHA, U.S. Environmental Protection Agency (EPA), and authorized state or local agencies have authority to inspect any facility that is subject to health, safety, and environmental legislation. Inspections may be announced or unannounced. This particular inspector indicated that the project was targeted for an inspection because the work was funded by the American Recovery and Reinvestment Act (ARRA).

Enterprise Standard Operating Procedure (SOP) HSE-201, *Agency Inspections and Communications*, describes the responsibilities, procedures, and requirements associated with inspections conducted by external regulatory agencies, as well as the methods for communicating information to key individuals. This Target Zero Bulletin is a brief summary of what to do in the event of an agency inspection at your site. Refer to the SOP for more specific guidance.

### **Notification of Inspections**

- If the inspection is an announced regulatory agency inspection, the Project Manager (PM) should notify the Responsible Health and Safety Manager (RHSM) and Responsible Environmental Manager (REM) well in advance of the inspection.
- If an unannounced agency inspector visits one of our projects, Field personnel must immediately notify the project Emergency Response Coordinator (ERC). Typically the ERC is the Safety Coordinator (SC).
- The **ERC must immediately notify the RHSM/REM**, as appropriate, of unannounced inspections, or designate someone to call the RHSM/REM. The RHSM/REMs can provide guidance to the field staff and PM.

### **Inspector Credential Verification**

- Upon arrival, the ERC must request the inspector to provide official credentials. Record the inspector's name and office phone number or obtain the inspector's business card.
- The inspector shall sign the visitors log and be given a site-specific health, safety, and environmental protection briefing.
- The inspector shall meet any site access requirements associated with security clearances, specialized training, and medical monitoring. The CH2M HILL representative shall verify that the inspector possesses these requirements; access will only be granted to those areas where appropriate access requirements are met. Some inspectors have the authority to gain access to any work area at any time, such as an inspector with a search warrant. In these cases, we can stop work operations as necessary to protect the safety of the inspector(s).

### **Opening Conference**

- The CH2M HILL Project Manager, ERC, RHSM, or REM, and the inspector shall determine attendees for the opening conference. The RHSM (for OSHA and other worker health and safety inspections) or REM (for environmental inspections) shall join the opening conference via conference call.
- The inspector shall inform CH2M HILL of the purpose of the inspection and provide a copy of the complaint, if applicable.

- 
- The inspector shall outline the scope of the inspection, including employee interviews conducted in private, physical inspection of the workplace and records, possible referrals, discrimination complaints, and the closing conference(s).

#### Requests for OSHA Logs

- An OSHA inspector may request to review the project OSHA Injury/Illness log, better known as the OSHA 300 Log. Contact your RHSM for assistance in obtaining the OSHA 300 Log.
- Field projects with a continuous duration of one year or longer are considered to be separate establishments and are required to maintain an OSHA 300 log specific to the project. The project OSHA 300 log should be maintained onsite and kept current.
- Recordable injuries and illnesses sustained on field projects less than one year in duration are maintained on the CH2M HILL office log where the injured employee is based.

#### The Inspection

- The scope of the inspection shall be limited to that indicated by the inspector in the opening conference. The inspector shall be escorted to relevant areas only. The ERC or other designated by the RHSM or REM must accompany the inspector during the inspection.
- Ensure that the inspection is limited to the scope that the inspector disclosed during the opening conference. The ERC should always take notes which identify: areas inspected, machinery or equipment and materials examined, employees or other persons interviewed, and photographs taken by the inspector.
- The inspector will observe safety, health, and environmental conditions and practices and document the inspection process. The inspector may also take photos and instrument readings, examine records, collect air samples, measure noise levels, survey existing engineering controls, and monitor employee exposure to toxic vapors, gases, and dusts.
- CH2M HILL should gather duplicate information (photographs, readings, samples) in the same manner and condition as the inspector. If the equipment needed to take duplicate samples is not onsite, ask the inspector if the sampling can wait until the equipment is available. If samples are taken, request a description of the tests that the agency intends to perform on the samples and request results as soon as they are available.
- Employees may be questioned during the inspection tour. The employee can refuse to speak to an inspector, can speak to the inspector with a company representative (including management) present, or can speak to the inspector privately. It is CH2M HILL policy that employees who wish to speak to the inspector are not discriminated against, intimidated, or otherwise mistreated for exercising their rights during compliance inspections.
- Copies of documents should not be provided to the inspector without the approval of the RHSM or REM or Legal Insurance Department (LID). **DO NOT** voluntarily release documents. Respond only to inspection team requests.
- During the course of the inspection, the inspector may point out violations. For each violation, the CH2M HILL representative should ask the inspector to discuss possible corrective action. Where possible, violations detected by the inspector should be corrected immediately and noted by the inspector as corrected.
- For those items which cannot be corrected immediately, an action plan shall be formulated for timely correction. In any instance, employees exposed to hazards shall be removed from the area.

#### Closing Conference

After the inspection, a closing conference is normally held as follows:

- The CH2M HILL PM, ERC, RHSM or REM shall be involved via conference call in the closing conference, at a minimum;
- The inspector shall describe the apparent violations found during the inspection and other pertinent issues as deemed necessary by the inspector. CH2M HILL shall be advised of their rights to participate in any subsequent conferences, meetings or discussions. Any unusual circumstances noted during the closing conference shall be documented by the ERC;
- The inspector shall discuss violations observed during the inspection and indicate for which violations a citation and a proposed penalty may be issued or recommended;

- 
- The ERC shall request receipts for all samples and approved documents photocopied by the inspector, request a photocopy of the inspector's photograph log, and request a copy of the final inspection report; and
  - Any documentation from an agency inspection must be transmitted immediately to the RHSM or REM, and LID.

**Unannounced regulatory agency inspections may happen at any time on our projects -**

**Get your RHSM/REM and PM involved immediately if an Inspector arrives.**

**CH2M HILL HEALTH AND SAFETY PLAN**

**Attachment 10**

**Completed CH2M HILL AHAs**

<b>Activity:</b> Indian Head Site 47 Predesign Investigation  <b>Description of the work:</b> Oversight of the following tasks: utility clearance, air knifing to confirm clearance to 7 ft bgs, MIP sampling via direct push, direct push soil and groundwater sampling, monitoring well installation by hollow stem auger drill rig, surveying of monitoring wells, and IDW transport and disposal. Groundwater sampling by CH2M HILL.	<b>Date:</b> 02/14/2012
	<b>Project Name:</b> Indian Head Site 47 Predesign Investigation
	<b>Site Supervisor:</b> TBD
	<b>Site Safety Officer:</b> TBD
	<b>Review for latest use:</b> Before the job is performed

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)
Utility Clearance (base)	Utility strike	Confirm base has completed utility check
Utility Clearance (3 <sup>rd</sup> party)	Utility strike	Have oversight of 3 <sup>rd</sup> party utility clearance, confirm they clear the entire area of where subsurface disturbance will occur. Watch for linear pavement cuts and other surface expressions of utilities while doing clearance. Confirm 3 <sup>rd</sup> party clearance has maps of base utilities while doing clearance. Make sure clearance contractor has the correct clearance equipment.
Utility Clearance (3 <sup>rd</sup> party)	Pinch/strain hazards, biological hazards	Watch utility clearance sub for the following: Use caution opening vault lids to confirm orientation of underground utilities. Lift with your legs, not your back. Watch fingers while lifting lid, use crowbar or lifting tool. Watch for wasps and spiders while opening utilities.

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)
Utility clearance (air knife)	Utility strike	Confirm air knifing goes to depth specified in HASP and diameter of drilling, in correct location. Where dangerous utilities are known to exist in within 5' of location, do positive clearance, i.e. air knife to expose the utility in several areas to show it's path and depth nearest the area of interest.
Utility clearance (air knife)	Flying debris	Have appropriate PPE when using water or air to cut formation, splash shield or goggles when air knifing, Follow HSP for appropriate PPE.
	noise	Use hearing protection when using vacuum for air knifing.
	Vacuum hose weight and suction	Make sure hands and feet stay clear of the suction hose end, watch that utility contractor is handling hose carefully.
Site Set Up/drilling	Manual Lifting	<ul style="list-style-type: none"> <li>• Test load first, if required get assistance.</li> <li>• Proper lifting techniques (lift with the legs and not the back) must be followed.</li> <li>• Know where the load is going before it is moved.</li> <li>• Do not twist the body when moving load.</li> <li>• Ensure there is a clear area for the load.</li> <li>• No employee shall lift a load over 40 lbs unless safety coordinator has evaluated lift.</li> <li>• Avoid area of drill rig while driller is moving rig, setting up, and mast is being raised.</li> <li>• Use hard hat, safety glasses, steel toe boots, nitrile gloves while handling sample</li> </ul>

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)
Site Set Up/drilling	Injuries	<ul style="list-style-type: none"> <li>• All employees shall know the location of the first aid kit.</li> <li>• All employees shall know the proper procedures for reporting an injury.</li> <li>• All employees shall have access to emergency telephone numbers.</li> <li>• All employees shall know the location of the nearest phone or the person with a cellular phone.</li> </ul>
Site Set Up/drilling	Bloodborne pathogens	<ul style="list-style-type: none"> <li>• Proper PPE shall be worn when treating injured persons</li> <li>• Bloodborne pathogen kits shall be available at each site.</li> </ul>
	Biological hazards	<ul style="list-style-type: none"> <li>• Watch for poison ivy, use appropriate PPE if you expect to see it at the site as specified in HSP.</li> <li>• Follow HSP for ticks</li> <li>• Use insect repellent for mosquitos</li> </ul>
Drilling/MIP/direct push	Hand and Power Tool safety issues	<ul style="list-style-type: none"> <li>• Defective hand tools should be removed from service immediately.</li> <li>• GFCI shall be used on extension cords.</li> <li>• Splices are not allowed on extension cords.</li> <li>• Use tools or sampling devices for intended purpose. Only (i.e.: hammer as hammer, not wrench as hammer, etc.)</li> <li>• Use intrinsically safe or non-sparking tools in flammable environments.</li> </ul>

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)
Drilling/MIP/direct push	Slips, Trips and Falls	<ul style="list-style-type: none"> <li>• Walk in designated areas only, ensure proper footing.</li> <li>• Ensure only authorized personnel and equipment enters area.</li> <li>• Use three point climbing technique.</li> <li>• Ensure ladders have proper footing and are tied off is applicable.</li> <li>• Store unused materials and supplies properly.</li> <li>• Perform good housekeeping measures, clean up spills immediately.</li> <li>• Slip resistant ladders, surfaces, and steps.</li> </ul>
Drilling/MIP/direct push	Heat Stress	<ul style="list-style-type: none"> <li>• Drink plenty of clear liquids.</li> <li>• Know signs of heat stress</li> <li>• Take breaks as necessary</li> <li>• Perform physiological monitoring as required per HSP</li> </ul>
	Cold stress	<ul style="list-style-type: none"> <li>• Dress in layers,</li> <li>• Wear appropriate clothing for the weather, hat, correct boots, gloves</li> <li>• Take warming breaks in vehicle as necessary</li> </ul>
	Overhead utilities	Confirm all drilling locations are greater than 10 feet from overhead utilities, and mast can be raised staying greater than 10 feet from overhead utilities. Follow HSP for guidance on distance requirements from utilities. Don't drive drill rig with the mast up. Hearing protection devices will be kept clean and sanitary between uses.

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)
	Noise issues	Use hearing protection when standing in the vicinity of the operating drill rig or direct push rig. Monitor noise levels to confirm hearing protection factor is sufficient to protect you from the noise levels. Hearing protection devices will be kept clean and sanitary between uses.
	Entanglement/crushing in augers	Oversight to never be close enough to come in contact with spinning augers. Know where the kill switch(s) is/are and ensure drill rig operator has verified it is functional.
	Hit by suspended load	Set work station up so as to be facing drill rig/direct push rig in a upwind position when possible. Make sure work area is greater than 1 mast length from the rig, or the greater of maximum suspended rod string length or mast length. This prevents being struck by falling tools at the work station site.
Drilling/MIP/direct push	Inclement weather	Monitor weather for adverse conditions prior to the start of each drilling/direct push day. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.
	Rig inspection-hazard from equipment failure	Make sure driller inspects drill rig daily. Confirm all wire ropes are satisfactory and wire rope connections are sufficient for the job. Check emergency shut off daily.

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)
	Rig stability	Confirm at each location, rig is stabile and will not tip over. Jacks have sufficient jack blocks so neither side will sink into ground enough to cause the drill rig to become unstable.  When moving rig, confirm path of travel is sufficiently level and firm that rig rollover is not a safety concern.
	Cuts by spur on auger flight	Make sure driller doesn't clean augers with gloved hands.
	MIP chemical safety	Confirm MIP chemicals are stored securely, MSDSs are available, and MIP subcontractor has spill kit available.
	Fire	Follow HSP for fire safety. Maintain fire extinguisher available for hot work. Maintain fire watch for 30 minutes after hot work.
IDW transport	Crushed by falling load	If driller is to move IDW drums, confirm he has a safe method of lifting and moving drums, and that no one gets under a suspended load, and that loads are pulled with a tagline rather than directly on the load. Maintain adequate separation distance when moved.
	Crushed by loose drum	Drums are to be secured prior to movement. Watch hand placement for pinch/crush hazards when moving drums.
Repairs up mast	Falling from mast	Worker must be in safety harness and always tied off when climbing mast. CH2M HILL staff will not assist with rig maintenance/repair actions.

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)
Monitoring well installation	Skin/eye protection from grout, respiratory protection from mixing grout.	Use PPE when driller is mixing and pouring/pumping bentonite cement grout. Confirm hose connections are secure when pumping grout. Stand upwind whenever possible. Minimize cement dust in air when mixing.
	Cuts from knife when opening bagged well materials.	If driller needs to use knife to open bagged well materials, make sure he has Kevlar glove on other hand, and has been trained on cutting away from hand and body, and there is no one else in range of the knife.
Groundwater sampling-unpacking coolers/organizing bottleware	Cuts from broken bottleware, exposure to acid preservatives.	Wear nitrile gloves while unpacking bottleware, Wear heavy leathe or Kevlar gloves over nitriles if you suspect broken glass in coolers. Use caution, expect broken bottleware.
Accessing and opening well	<ol style="list-style-type: none"> <li>1. Over tightened bolts, rusty locks/slipping causing cuts/abrasions to hands.</li> <li>2. PID readings &gt; 5ppm</li> <li>3. Contact with potentially contaminated water.</li> <li>4. Bee/Wasps nests.</li> </ol>	<ol style="list-style-type: none"> <li>1. Know the limitations of all hand tools. Use socket wrenches and bolt cutters, as necessary, to remove old, rusty locks</li> <li>2. Allow well to vent, if readings continue over 5 ppm in the BZ then recap and advise management. If you get over 2 ppm in the BZ continuously, pop a draeger tube to check for Carbon Tetrachloride .</li> <li>3. Wear nitrile gloves</li> <li>4. Use partners help with equipment.</li> <li>5. PID</li> <li>6. Nitrile gloves</li> <li>7. Boots</li> <li>8. Work gloves</li> <li>9. Call for bee suit/contractor to remove hives if needed.</li> </ol>

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)
Water level measurement	1. Winding of meter/repetitive motion, probe recoiling too quickly striking personnel, leaning over well	1. Share physical aspects of job with partner 2. Recoil meter slowly as the probe reaches meter
Pumping wells to sample	Chemical exposure	Don't let water contact skin, wear gloves and if necessary other PPE.
Field test kit readings	Cuts from ampoules	Put all used ampoules in a drinking water bottle for disposal. Watch hands around broken ends.
Site Breakdown	1. Moving buckets of purge water/pinch points, muscle strain 2. Pulling tubing from pump, danger of strain or sudden release.	1. Use partner to move pails/carboys from ground to vehicle, wear safety glasses and nitrile gloves. Do not rush. 2. Wrap tubing around well top or pinch it in the protective casing cap to avoid pulling in two directions when removing tubing from the pump. Pulling from one direction is more controlled. Watch for sharp edges on well protective cap.
Surveying	Biological hazards	<ul style="list-style-type: none"> <li>• Watch for poison ivy, use appropriate PPE if you expect to see it at the site and follow procedures specified in HSP.</li> <li>• Follow HSP for ticks</li> <li>• Use insect repellent for mosquitos</li> </ul>

<b>Equipment to be used</b> (List equipment to be used in the work activity)	<b>Inspection Requirements</b> (List inspection requirements for the work activity)	<b>Training Requirements</b> (List training requirements including hazard communication)
First aid kit with ice pack.	Make sure first aid supplies haven't expired, and that chemical ice pack hasn't gone off by itself.	1 <sup>st</sup> Aid / CPR
Minirae Noise monitor	Calibrate daily Calibrate as per manufacturers instructions	NA
Hard hat safety glasses steel toe boots Nitrile gloves	Inspect before use.	NA

**PRINT NAME**

**SIGNATURE**

**Supervisor Name:** \_\_\_\_\_

\_\_\_\_\_

**Date/Time:** \_\_\_\_\_

**Safety Officer Name:** \_\_\_\_\_

\_\_\_\_\_

**Date/Time:** \_\_\_\_\_

**Employee Name(s):** \_\_\_\_\_

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**Date/Time:** \_\_\_\_\_

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**CH2MHILL**

**CH2M HILL HEALTH AND SAFETY PLAN**

**Attachment 11**

**Material Safety Data Sheets**

# HYDROCHLORIC ACID

OLIN CORPORATION -- HCL (MURIATIC  
ACID), CPE298002

## MSDS Safety Information

FSC: 6810  
NIIN: 00-045-8918  
MSDS Date: 03/28/1997  
MSDS Num: CHVMT  
Product ID: HCL (MURIATIC ACID), CPE298002  
MFN: 02  
Responsible Party  
Cage: 99530  
Name: OLIN CORPORATION  
Address: 501 MERRITT 7  
Box: 4500  
City: NORWALK CT 06856-4500  
Info Phone Number: 203-356-3449  
Emergency Phone Number: 800-OLIN-911 (1-800-654-6911)  
Published: Y

## Contractor Summary

Cage: 99530  
Name: OLIN CORPORATION  
Address: 501 MERRITT 7  
Box: 4500  
City: NORWALK CT 06856-4500  
Phone: 203-750-3000/800-511-MSDS

## Item Description Information

### Ingredients

Cas: 7647-01-0  
RTECS #: MW4025000  
Name: HYDROCHLORIC ACID (SARA 302/313) (CERCLA)  
% Wt: 8-38  
OSHA PEL: C 5 PPM  
ACGIH TLV: C 5 PPM  
EPA Rpt Qty: 5000 LBS  
DOT Rpt Qty: 5000 LBS

Cas: 7732-18-5  
Name: WATER  
% Wt: 62-93  
OSHA PEL: N/K (FP N)  
ACGIH TLV: N/K (FP N)

Name: SUP DAT: OCCUR TO ENTIRE GI TRACT, INCL STOM & INTESTINES,  
CHARACTERIZED BY NAUS, VOMIT, DIARR, ABDOM PAIN,

Name: ING 3: BLEEDING, &/TISS ULCERATION. INGEST CAUSES SEVERE DAMAGE TO GI  
TRACT W/POTENTIAL TO CAUSE PERFORATION.

Name: ING 4: CHRONIC: INHAL: RPTD/PRLNG EXPOS TO CONCS >ACCEPTED OCCUP LIMS  
MAY CAUSE DENTAL DISCOLORATION & EROSION

Name: ING 5: OF TEETH. SKIN: RPTD CONT W/MIST HAS BEEN REPORTED TO CAUSE CONT  
DERM (SKIN RASH). PRLNG/RPT EXPOS W/LIQ

Name: ING 6: MAY CAUSE PERM DMG. INGEST: INGEST OF SIGNIFICANT AMTS IS UNLIKELY BECAUSE OF ITS ACUTE CORR ACTION.

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Name: FIRST AID PROC: INHAL: IF PERS EXPERIENCES NAUS, HDCH/DIZZ, PERS SHOULD STOP WORK IMMED & MOVE TO FRESH AIR  
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Name: ING 8: UNTIL THESE SYMPS DISAPPEAR. IF BRTHG IS DFCLT, ADMIN OXYGEN, KEEP PERS WARM & AT REST. CALL MD. IN THE

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Name: ING 9: EVENT THAT INDIVIDUAL INHALES ENOUGH VAP TO LOSE CONSCIOUSNESS, PERS SHOULD BE MOVED TO FRESH AIR AT ONCE  
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Name: ING 10: & MD SHOULD BE CALLED IMMED. IF BRTHG HAS STOPPED, ARTF RESP SHOULD BE GIVEN IMMED. IN ALL CASES, ENSURE

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Name: ING 11: ADEQUATE VENTILATION AND PROVIDE RESPIRATORY PROTECTION BEFORE THE PERSON RETURNS TO WORK.  
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Name: SPILL PROC: REQS. HAZ CONCS IN AIR MAY BE FOUND IN LOC SPILL AREA & IMMED DOWNWIND. AIR RELEASE. VAPS MAY BE

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Name: ING 13: SUPPRESSED BY USE OF WATER FOG/VAP SUPPRESSANT FOAM. DIKE & CONTAIN ALL RUN-OFF WATER FOR TREATMENT AS  
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Name: ING 14: HAZ WASTE. WATER RELEASE: THIS MATL IS HVR/AIR & SOL IN WATER. CONTAIN CONTAM WATER BY BLDG A DIKE OF

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Name: ING 15: COMPATIBLE ABSORBS. VACUUM/PUMP MATL TO NEUT CONTR & TREAT. LAND SPILL: COMPATIBLE ABSORBS: SAND, CLAY  
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Name: ING 16: SOIL & COMMERCIAL ABSORBS. SPILL RESIDUERS: DISP OF PER GUIDELINES UNDER WASTE DISP. THIS MATL MAY BE

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Name: ING 17: NEUT FOR DISP; YOU ARE REQUESTED TO CONT OCEAN AT 800-OLIN-911 BEFORE BEGINNNING ANY SUCH OPERATION.  
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#### Health Hazards Data

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LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route Of Entry Inds - Inhalation: YES

Skin: YES

Ingestion: YES

Carcinogenicity Inds - NTP: NO

IARC: NO

OSHA: NO

Effects of Exposure: ACUTE: INHAL: MIST/VAP/HYDROGEN CHLORINE GAS MAY CAUSE IRRIT OF MUC MEMB & RESP TRACT W/SYMPS OF BURNING, CHOKING \* COUGHING. AT EXPOS CONCS >TLV, DMG MAY OCCUR TO MUC MEMB (ULCERATIONS OF NOSE & THRO AT) & RESP TRACT. AT THESE HIGH CONCS, SEV BRTHG DFCLTYS MAY OCCUR WHICH MAY BE DELAYED IN ONSET & MAY (EFTS OF OVEREXP)

Explanation Of Carcinogenicity: NOT RELEVANT.

Signs And Symptoms Of Overexposure: HLTH HAZ: BE DUE TO PULM EDEMA (FLUID IN LUNG) /LARYNGEAL EDEMA/SPASM. SKIN: HYDROFLUORIC ACID MIST MAY RAPIDLY CAUSE SKIN INFLAMM & BURNS. DIRECT CONT OF LIQ WILL BE CORR TO SKIN & CAN CAUSE SEV IRRI T &/BURNS CHARACTERIZED BY REDNESS, SWELL & SCAB FORM. POTENTIAL FOR SCARRING & ULCERATION OF CONTACTED TISS (SUP DAT)

Medical Cond Aggravated By Exposure: RESPIRATORY AND CARDIOVASCULAR DISEASE.

First Aid: EYES: IMMED FLUSH W/LGE AMTS OF WATER FOR AT LEAST 15 MIN, OCCAS LIFTING UPPER & LOWER EYELIDS. CALL MD AT ONCE. SKIN: IMMED FLUSH W/WATER FOR AT LEAST 15 MIN. CALL MD. IF CLTHG COMES IN CONT W/PROD, IT SHOULD BE REMOVED IMMED & LAUNDERED BEFORE REUSE. INGEST: IMMED DRINK LGE QTYS OF WATER. DO NOT INDUCE VOMIT. CALL MD AT ONCE. DO NOT GIVE ANYTHING BY MOUTH IF PERS IS UNCON/HAVING CONVLS.

## Handling and Disposal

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Spill Release Procedures: FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC AT 800-424-9300. REPORTABLE QUANTITY: THIS PROD IS SUBJECT TO REPORTABLE QTY W/RESPECT TO HYDROFLUORIC ACID. RQ'S ARE SUBJECT TO CHANGE & REFERENCE SHOU LD BE MADE TO 40 CFR 302.4 FOR CURRENT

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: CARE MUST BE TAKEN TO PVNT ENVIRON CONTAM FROM USE OF MATL. THE USER HAS THE RESPONSIBILITY TO DISP OF UNUSED MATL, RESIDUES & CONTRS IN COMPLIANCE W/ALL RELEVANT LOC, STATE & FED LAWS & REGS REGARDIN G TREATMENT, STOR & DISP FOR HAZ & NON HAZ WASTES

Handling And Storage Precautions: DO NOT TAKE INTERNALLY. AVOID CONT W/SKIN, EYES & CLTHG. AVOID BRTHG MIST/VAP. STORE IN COOL, CLEAN, WELL-VENTED AREA. DO NOT STORE >100F (>38C).

Other Precautions: DO NOT EXPOSE TO DIRECT LIGHT. SHELF LIFE LIMITATIONS: 1 YEAR. GLASS/POLYETHYLENE CONTRS REC. WHEN SHIPPED W/OXIDIZERS, MUST BE SEPARATED BY 18 INCHES, W/WOOD PALLETS & ABSORB MATL IN BETWEEN.

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## Fire and Explosion Hazard Information

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Extinguishing Media: ON SMALL FIRES, USE DRY CHEMICAL OR CARBON DIOXIDE. ON LARGE FIRE, USE WATER.

Fire Fighting Procedures: WEAR NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N). USE WATER TO COOL CONTAINERS EXPOSED TO FIRE.

Unusual Fire/Explosion Hazard: NOT COMBUSTIBLE BUT CONTACT WITH COMMON METALS PRODUCES FLAMMABLE HYDROGEN GAS. MAY ALSO RELEASE CHLORINE GAS BY REACTION WITH OXIDIZING AGENTS.

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## Control Measures

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Respiratory Protection: NONE SPECIFIED BY MANUFACTURER. ALLY REQUIRED. IF VAPORS, MISTS, OR AEROSOLS ARE GENERATED, WEAR A NIOSH APPROVED FULL FACEPIECE, EQUIPPED WITH CHEMICAL CARTRIDGES APPROVED FOR HYDROGEN CHLORIDE.

Ventilation: N/R EXHST VENT IS REC IF VAPS, MIST/AEROSOLS ARE GENERATED. OTHERWISE, USE GOOD GENERAL ROOM VENTILATION.

Protective Gloves: NEOPRENE GLOVES.

Eye Protection: ANSI APRV CHEM SFTY GOGGS&FFACE SHLD (FPN)

Other Protective Equipment: ANSI APPRVD EMER EYEWASH & DELUGE SHOWER (FP N). BOOTS, APRON. FULL IMPERMEABLE SUIT REC IF EXPOS TO LGE PORTION OF BODY.

Work Hygienic Practices: UPON CONTACT WITH SKIN OR EYES, WASH OFF WITH WATER.

Supplemental Safety and Health: MATLS TO AVOID: METALLIC OXIDES, MAGNESIUM, OLEUM, PERCHLORIC ACID, ZINC. EFTS OF OVEREXP: ALSO EXISTS. EYE: EXPOS TO MIST MAY RSLT IN IRRIT &/SEV BURNS W/PERM DMG & POSS LOSS OF SIGHT. DIRECT CONT W/ LIQ WILL BE CORR TO EYE W/RSLTG SEV BURNS, POTENTIAL VISUAL IMPAIRMENT/LOSS OF SIGHT. INGEST: IRRIT &/BURNS CAN

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## Physical/Chemical Properties

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B.P. Text: >212F, 100C

M.P/F.P Text: -101F, -74C

Vapor Pres: <210 @ 20C

Vapor Density: 1.3

Spec Gravity: 1.035-1.188

PH: <1

Evaporation Rate & Reference: APPROX 1 (WATER=1)

Solubility in Water: COMPLETE

Appearance and Odor: CLEAR, COLORLESS LIQUID; PUNGENT, SUFFOCATING ODOR

Percent Volatiles by Volume: 100

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## Reactivity Data

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Stability Indicator: YES

Stability Condition To Avoid: HEAT, EXPOSURE TO SUNLIGHT.

Materials To Avoid: ALKALINE MATLS, ALUMINUM, AMINES, CARBONATES, IRON, SULFURIC ACID, HYDROXIDES, LEATHER & OTHER FABRICS, (SUP DAT)

Hazardous Decomposition Products: FLAMM HYDROGEN GAS BY REACTION W/MANY METALS

(E.G. ALUMINUM). CHLORINE GAS IS RELEASED BY REACTION W/OXIDIZING AGENTS.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT.

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Toxicological Information

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Ecological Information

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MSDS Transport Information

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Regulatory Information

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Other Information

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HAZCOM Label

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Product ID: HCL (MURIATIC ACID), CPE298002

Cage: 99530

Company Name: OLIN CORPORATION

Street: 501 MERRITT 7

PO Box: 4500

City: NORWALK CT

Zipcode: 06856-4500

Health Emergency Phone: 800-OLIN-911; (1-800-654-6911)

Label Required IND: Y

Date Of Label Review: 06/23/1998

Status Code: C

Label Date: 06/23/1998

Origination

Chronic Hazard IND: Y

Eye Protection IND: YES

Skin Protection IND: YES

Signal Word: DANGER

Respiratory Protection IND: YES

Health Hazard: Slight

Contact Hazard: Severe

Fire Hazard: None

Reactivity Hazard: None

Hazard And Precautions: ACUTE: INHAL: MIST/VAP/HCL GAS MAY CAUSE IRRIT OF  
MUCOUS MEMB & RESP TRACT W/BURN SYMPS, CHOKES & COUGH. AT EXPOS

>TLV, MAY DMG MUC MEMB & RESP TRACT. AT HIGH CONÇ, SEV BRTHG DFCLTYS

WHICH MAY BE DELAY ED IN ONSET & BE DUE TO PULM EDEMA, LARYNGEAL

EDEMA/SPASM. SKIN: HCL ACID MIST MAY CAUSE INFLAM & BURNS. DIRECT CONT OF

LIQ IS CORR CAUSING SEV IRRIT &/BURNS & ULCER OF CONTACTED TISS. EYE:

EXPOS TO M IST MAY CAUSE IRRIT &/SEV BURNS W/PERM DMG & POSS SIGHT

LOSS. INGEST: IRRIT &/BURNS CAN OCCUR TO GI TRACT. CHRONIC: RPTD/PRLNG

EXPOS TO HI CONC MAY CAUSE DENTAL DISCOLOR & EROSION. SKIN: DERM. PERM DM

G. INGEST: INLIKELY BECAUSE OR ACUTE CORR ACTION.

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Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or viability by or to any person or persons outside the Department of Defense nor any person or persons contracting with any instrumentality of the United States of America and disclaims all liability for such use. Any person utilizing this instruction who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation regardless of similarity to a corresponding Department Of Defense or other government situation.

# 24 NITRIC ACID

SPEX INDUSTRIES INC -- NITRIC ACID BLANK, PLBLK-HN03 -- 6850-00N020537

## MSDS Safety Information

FSC: 6850  
MSDS Date: 03/04/1988  
MSDS Num: BLRMY  
LIIN: 00N020537  
Tech Review: 08/02/1995  
Product ID: NITRIC ACID BLANK, PLBLK-HN03  
Responsible Party  
Cage: 07977  
Name: SPEX INDUSTRIES INC  
Address: 3880 PARK AVENUE  
City: EDISON NJ 08820 US  
Info Phone Number: 201-549-7144  
Emergency Phone Number: 201-549-7144  
Preparer's Name: LINDA OLCHVARY  
Review Ind: N

## Contractor Summary

Cage: 07977  
Name: SPEX CERTIPREP INC  
Address: 203 NORCROSS AVE  
City: METUCHEN NJ 08840 US  
Phone: 732-549-7144

## Ingredients

Cas: 7697-37-2  
RTECS #: QU5775000  
Name: NITRIC ACID (SARA III)  
% by Wt: 5  
OSHA PEL: 2 PPM/4 STEL  
ACGIH TLV: 2 PPM/4 STEL; 9192  
EPA Rpt Qty: 1000 LBS  
DOT Rpt Qty: 1000 LBS  
Ozone Depleting Chemical: N

## Health Hazards Data

LD50 LC50 Mixture: LC50: (INHALE/RAT) 224 PPM(NO2)/30M  
Route Of Entry Inds - Inhalation: YES  
Skin: YES  
Ingestion: YES  
Carcinogenicity Inds - NTP: NO  
IARC: NO  
OSHA: NO

Effects of Exposure: CONC NITRIC ACID MAY BE FATAL IF TOO MUCH IS  
INHALED/ABSORBED THRU SKIN. CONC NITRIC ACID VAP/MIST IS IRRITANT OF  
EYES, MUC MEMB & SKIN. IN CONT W/EYES, PRODUCES SEVERE BURNS WHICH MAY  
RESULT IN PERMANENT DMG & VISUAL IMPAIRMENT. ON SKIN, LIQ/CONC VAP  
PRODUCES IMMEDIATE, SEVERE & PENETRATING BURNS; CONC (SEE EFFECTS OF OVEREXPOSURE)

Explanation Of Carcinogenicity: NOT RELEVANT

Signs And Symptoms Of Overexposure: HEALTH HAZARD: SOLUTION CAUSES DEEP ULCERS &  
STAINS SKIN BRIGHT YELLOW/YELLOWISH BROWN COLOR. VAP & MIST MAY ERODE  
EXPOSED TEETH WITH Prolonged EXPOSURE. INGESTION OF LIQ WILL CAUSE IMMEDIATE PAIN & BURNS  
OF MOUTH, ESOPHAGUS & GI TRACT. INHALATION MAY BE FATAL CAUSING SPASM, INFLAM

& EDEMA OF LARYNX & BRONCHI, CHEM PNEUM & PULM EDEMA. SYMP (SUPP DATA)  
Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.  
First Aid: EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES OCCASIONALLY  
LIFTING UPPER AND LOWER EYELIDS. SKIN: REMOVE CONTAMINATED CLOTHING,  
THEN FLUSH WITH WATER FOR AT LEAST 15 MINUTES. WASH CLOTHING THOROUGHLY  
BEFORE REUSE. INHAL: MOVE TO FRESH AIR. IF IRRITATION CONTINUES, CALL MD  
IMMEDIATELY. INGEST: CALL MD IMMEDIATELY (FP N).

=====  
Handling and Disposal  
=====

Spill Release Procedures: VENT AREA. DILUTE SPILL W/WATER & NEUT W/ SODA  
ASH, LIMESTONE, ETC. WIPE UP & PUT IN A SEALED CNTNR FOR PROPER DISP.  
WASH SPILL SITE OFF W/WATER AFTER MATL PICK UP IS COMPLETE. WEAR CHEM  
RESISTANT GLASSES, GLOVES & CLOTHING. WEAR NIOSH/MSHA APPROVED RESP.  
Neutralizing Agent: SEE SPILL/RELEASE PROCEDURES.  
Waste Disposal Methods: CONTACT LOCAL HAZARDOUS OR CHEMICAL WASTE DISPOSAL  
AGENCY FOR REGULATIONS. DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL,  
STATE AND LOCAL REGULATIONS (FP N).  
Handling And Storage Precautions: CONCENTRATED NITRIC ACID WILL ATTACK  
SOME FORMS OF PLASTICS, RUBBER AND COATINGS. STORE AT ROOM TEMPERATURE.  
KEEP TIGHTLY SEALED WHEN NOT IN USE.  
Other Precautions: HAVE IMMEDIATE AVAILABILITY OF AN EYE WASH IN CASE OF  
EMERGENCY. AVOID INHALATION, INGESTION AND CONTACT WITH EYES AND SKIN.

=====  
Fire and Explosion Hazard Information  
=====

Flash Point Text: NOT COMBUSTIBLE  
Extinguishing Media: APPROPRIATE TO SURROUNDING FIRE CONDITIONS.  
Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROT EQUIP  
(FP N). CONC HNO3 REACTS EXPLO W/COMBUST ORG/READILY OXIDIZABLE MATLS  
SUCH AS; ALCOHOL, WOOD, (SEE SUPP DATA)  
Unusual Fire/Explosion Hazard: CONC HNO3 IS NOT COMBUST, BUT IS STRONG  
OXIDIZER & ITS HEAT OF RXN W/REDUCING AGENTS/COMBUST MAY CAUSE IGNIT.  
CAN REACT W/METALS TO RELEASE FLAM HYDROGEN GAS.

=====  
Control Measures  
=====

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR.  
Ventilation: USE IN A CHEMICAL FUME HOOD.  
Protective Gloves: CHEMICAL RESISTANT GLOVES.  
Eye Protection: CHEM WORK GOGG/FULL LENGTH FACESHLD(FPN)  
Other Protective Equipment: CHEMICAL RESISTANT CLOTHING. EYE WASH IN CASE  
OF EMERGENCY AND A LAB COAT. DELUGE SHOWER (FP N).  
Work Hygienic Practices: WASH CAREFULLY AFTER USE.  
Supplemental Safety and Health: FIRE FIGHT PROC: TURPENTINE/METAL POWDERS/  
HYDROGEN SULFIDE/ETC. MATLS TO AVOID: ALCOHOL/WOOD/TURPENTINE, METAL  
POWDERS/HYDROGEN SULFIDE/ETC. CONT W/STRONG BASES WILL CAUSE VIOLENT  
SPATTERING. EFTS OF OVEREXP: INCL BURNING SENSATION, COUGH, WHEEZING,  
LARYNGITIS, SHORTNESS OF BREATH, HDCH, NAUS & VOMIT.

=====  
Physical/Chemical Properties  
=====

HCC: C1  
Spec Gravity: APPROXIMATELY 1  
Solubility in Water: SOLUBLE  
Appearance and Odor: TRANSPARENT WITH AN ACIDIC ODOR.

=====  
Reactivity Data  
=====

Stability Indicator: YES  
Stability Condition To Avoid: ELEVATED TEMPERATURES MAY CAUSE CONTAINERS  
TO BURST AND LIBERATE TOXIC NOX.  
Materials To Avoid: CONC HNO3 IS A POWERFUL OXIDIZING AGENT. IT REACTS  
EXPLO W/COMBUST ORG/READILY OXIDIZABLE MATLS SUCH AS; (SUPP DATA)  
Hazardous Decomposition Products: WILL RELEASE TOXIC NITROGEN OXIDE FUMES  
AND VAPORS.  
Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT

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Toxicological Information

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Ecological Information

=====

MSDS Transport Information

=====

Regulatory Information

=====

Other Information

=====

Transportation Information

=====

Responsible Party Cage: 07977  
Trans ID NO: 25204  
Product ID: NITRIC ACID BLANK, PLBLK-HN03  
MSDS Prepared Date: 03/04/1988  
Review Date: 01/17/1992  
Article W/O MSDS: N  
Multiple KIT Number: 0  
Unit Of Issue: NK  
Container QTY: NK

=====

Detail DOT Information

=====

DOT PSN Code: KFD  
DOT Proper Shipping Name: NITRIC ACID  
DOT PSN Modifier: OTHER THAN RED FUMING, WITH NOT MORE THAN 70 PERCENT  
NITRIC ACID  
Hazard Class: 8  
UN ID Num: UN2031  
DOT Packaging Group: II  
Label: CORROSIVE  
Special Provision: B2,B47,B53,T9,T27  
Non Bulk Pack: 158  
Bulk Pack: 242  
Max Qty Pass: FORBIDDEN  
Max Qty Cargo: 30 L  
Vessel Stow Req: D  
Water/Ship/Other Req: 44,66,89,90,110,111

=====

Detail IMO Information

=====

IMO PSN Code: KPF  
IMO Proper Shipping Name: NITRIC ACID  
IMO PSN Modifier: ,OTHER THAN RED FUMING,ALL CONCENTRATIONS  
IMDG Page Number: 8195  
UN Number: 2031  
UN Hazard Class: 8  
IMO Packaging Group: I/II  
Subsidiary Risk Label: -  
EMS Number: 8-03  
MED First Aid Guide NUM: 610

=====

Detail IATA Information

=====

IATA PSN Code: RWI  
IATA UN ID Num: 2031  
IATA Proper Shipping Name: NITRIC ACID  
IATA PSN Modifier: ,OTHER THAN RED FUMING, WITH 20% OR LESS NITRIC ACID  
IATA UN Class: 8

IATA Label: CORROSIVE  
UN Packing Group: II  
Packing Note Passenger: 807  
Max Quant Pass: 1L  
Max Quant Cargo: 30L  
Packaging Note Cargo: 813

=====

Detail AFI Information

=====

AFI PSN Code: RWI  
AFI Symbols: T  
AFI Proper Shipping Name: NITRIC ACID  
AFI PSN Modifier: ,OTHER THAN RED FUMING, WITH LESS THAN 20% NITRIC ACID  
AFI Hazard Class: 8  
AFI UN ID NUM: UN2031  
AFI Packing Group: II  
AFI Label: CORROSIVE  
Back Pack Reference: A12.11

=====

HAZCOM Label

=====

Product ID: NITRIC ACID BLANK, PLBLK-HN03  
Cage: 07977

Company Name: SPEX CERTIPREP INC  
Street: 203 NORCROSS AVE  
City: METUCHEN NJ  
Zipcode: 08840 US  
Health Emergency Phone: 201-549-7144  
Date Of Label Review: 10/18/1991  
Label Date: 10/18/1991  
Chronic Hazard IND: N  
Eye Protection IND: YES  
Skin Protection IND: YES  
Signal Word: DANGER  
Respiratory Protection IND: YES  
Health Hazard: Moderate  
Contact Hazard: Severe  
Fire Hazard: None  
Reactivity Hazard: None

Hazard And Precautions: ACUTE: CORROSIVE & FATAL IF TOO MUCH IS  
INHALED/ABSORBED THRU SKIN. CAUSES SEVERE EYE BURNS WHICH MAY RESULT IN  
PERMANENT DMG & VISUAL IMPAIRMENT. CAUSES SKIN BURNS, DEEP ULCERS &  
YELLOW/YELLOWISH BRO WN STAINS ON SKIN. SWALLOWING LIQ WILL CAUSE  
IMMEDIATE PAIN & BURNS OF MOUTH, ESOPHAGUS & GI TRACT. INHAL MAY BE  
FATAL CAUSING SPASM, INFLAM & EDEMA OF LARYNX & BRONCHI, CHEM PNEUMONIA  
& PULM EDEMA. A VOID INHAL, INGEST & EYE/SKIN CONTACT. CHRONIC EFTS:  
VAPOR & MIST MAY ERODE EXPOSED TEETH WITH PROLONGED EXPOSURE.

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other government situation.

# SODIUM HYDROXIDE

MSDS Number: **S4034** \* \* \* \* \* Effective Date: **08/02/01** \* \* \* \* \* Supersedes: **08/20/98**

## 1. Product Identification

**Synonyms:** Caustic soda; lye; sodium hydroxide solid; sodium hydrate

**CAS No.:** 1310-73-2

**Molecular Weight:** 40.00

**Chemical Formula:** NaOH

**Product Codes:**

J.T. Baker: 3718, 3721, 3722, 3723, 3728, 3734, 3736, 5045, 5565

Mallinckrodt: 7001, 7680, 7708, 7712, 7772, 7798

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hydroxide	1310-73-2	99 - 100%	Yes

## 3. Hazards Identification

### Emergency Overview

**POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup> Ratings** (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 0 - None

Reactivity Rating: 2 - Moderate

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: White Stripe (Store Separately)

### Potential Health Effects

#### Inhalation:

Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.

#### Ingestion:

Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of

tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appear days after exposure.

**Skin Contact:**

Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.

**Eye Contact:**

Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.

**Chronic Exposure:**

Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.

**Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

---

## 4. First Aid Measures

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

**Ingestion:**

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

**Skin Contact:**

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

**Note to Physician:**

Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

---

## 5. Fire Fighting Measures

**Fire:**

Not considered to be a fire hazard. Hot or molten material can react violently with water. Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.

**Explosion:**

Not considered to be an explosion hazard.

**Fire Extinguishing Media:**

Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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## 6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

## 7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

---

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

- OSHA Permissible Exposure Limit (PEL):

2 mg/m<sup>3</sup> Ceiling

- ACGIH Threshold Limit Value (TLV):

2 mg/m<sup>3</sup> Ceiling

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

### **Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

White, deliquescent pellets or flakes.

**Odor:**

Odorless.

**Solubility:**

111 g/100 g of water.

**Specific Gravity:**

2.13

**pH:**

13 - 14 (0.5% soln.)

**% Volatiles by volume @ 21C (70F):**

0

**Boiling Point:**

1390C (2534F)

**Melting Point:**

318C (604F)

**Vapor Density (Air=1):**

> 1.0

**Vapor Pressure (mm Hg):**

Negligible.

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.

**Hazardous Decomposition Products:**

Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Sodium hydroxide in contact with acids and organic halogen compounds, especially trichloroethylene, may cause violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of

personnel before vessel entry.

**Conditions to Avoid:**

Moisture, dusting and incompatibles.

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## 11. Toxicological Information

Irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe; investigated as a mutagen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
-----			
Sodium Hydroxide (1310-73-2)	No	No	None

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## 12. Ecological Information

**Environmental Fate:**

No information found.

**Environmental Toxicity:**

No information found.

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## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

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## 14. Transport Information

**Domestic (Land, D.O.T.)**

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**Proper Shipping Name:** SODIUM HYDROXIDE, SOLID

**Hazard Class:** 8

**UN/NA:** UN1823

**Packing Group:** II

**Information reported for product/size:** 300LB

**International (Water, I.M.O.)**

-----  
**Proper Shipping Name:** SODIUM HYDROXIDE, SOLID

**Hazard Class:** 8

**UN/NA:** UN1823

**Packing Group:** II

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----  
Ingredient TSCA EC Japan Australia

Sodium Hydroxide (1310-73-2) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient Korea --Canada-- DSL, NDSL Phil.

Sodium Hydroxide (1310-73-2) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient -SARA 302- -SARA 313-  
RQ TPQ List Chemical Catg.

Sodium Hydroxide (1310-73-2) No No No No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient CERCLA -RCRA- -TSCA-  
261.33 8(d)

Sodium Hydroxide (1310-73-2) 1000 No No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No  
SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No  
Reactivity: Yes (Pure / Solid)

**Australian Hazchem Code: 2R**

**Poison Schedule: S6**

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

**NFPA Ratings:** Health: 3 Flammability: 0 Reactivity: 1

**Label Hazard Warning:**

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

**Label Precautions:**

Do not get in eyes, on skin, or on clothing.

Do not breathe dust.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

**Label First Aid:**

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything

by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 8.

**Disclaimer:**

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

# SULFURIC ACID, < 10%

## 1. Product Identification

**Synonyms:** Sulfuric acid solution; Sulfuric Acid Volumetric Solutions 2.0 Normal and below

**CAS No.:** 7664-93-9

**Molecular Weight:** 98.07

**Chemical Formula:** H<sub>2</sub>SO<sub>4</sub> in H<sub>2</sub>O

**Product Codes:**

J.T. Baker: 4699, 4703, 4704, 5640, 5641, 5642, 5690, 5692, 5693, 5694

Mallinckrodt: 6843, 7610, H366, H372, H381, H389, H392, H641

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	0.1 - 10%	Yes
Water	7732-18-5	90 - 99%	No

## 3. Hazards Identification

### Emergency Overview

**DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup> Ratings (Provided here for your convenience)**

Health Rating: 2 - Moderate

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

### Potential Health Effects

#### Inhalation:

Corrosive. Effects should be less severe than from exposure to higher concentrations of sulfuric

acid. Symptoms may include irritation of the nose and throat, labored breathing, as well as lung edema, damage to the mucous membranes and upper respiratory tract.

**Ingestion:**

Corrosive. Effects should be less severe than from exposure to higher concentrations of sulfuric acid. Symptoms may include severe burns of the mouth, throat, and stomach. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death. May cause sore throat, vomiting, diarrhea.

**Skin Contact:**

Corrosive. Effects should be less severe than from exposure to higher concentrations of sulfuric acid. Symptoms may include redness, pain, and burns to the skin. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death.

**Eye Contact:**

Corrosive. Effects should be less severe than from exposure to higher concentrations of sulfuric acid. Symptoms may include blurred vision, redness, pain, and burns to eye tissue. Concentrated solutions can cause blindness.

**Chronic Exposure:**

Long term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.

**Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

---

## 4. First Aid Measures

First aid procedures given apply to concentrated solutions. Exposures to dilute solutions may not require these extensive first aid procedures.

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.

**Ingestion:**

DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Excess acid on skin can be neutralized with a 2% solution of bicarbonate of soda. Call a physician immediately.

**Eye Contact:**

Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

---

## 5. Fire Fighting Measures

**Fire:**

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition.

**Explosion:**

Contact with most metals causes formation of flammable and explosive hydrogen gas.

**Fire Extinguishing Media:**

Dry chemical, foam, water or carbon dioxide. Concentrated solutions are water reactive.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

---

## 6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

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## 7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat and incompatible materials. Do not wash out container and use it for other purposes. When diluting, always add the acid to water; never add water to the acid. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Protect from freezing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

For Sulfuric Acid:

- OSHA Permissible Exposure Limit (PEL) -

1 mg/m<sup>3</sup> (TWA)

- ACGIH Threshold Limit Value (TLV) -

1 mg/m<sup>3</sup>(TWA), 3 mg/m<sup>3</sup> (STEL), A2 - suspected human carcinogen for sulfuric acid contained in strong inorganic acid mists.

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area.

Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Clear, colorless solution.

**Odor:**

Odorless.

**Solubility:**

Miscible in water.

**Specific Gravity:**

ca. 1.0 (0.1%), 1.07 (10%)

**pH:**

1 N solution (ca. 5% w/w) = 0.3; 0.1 N solution (ca. 0.5% w/w) = 1.2; 0.01 N solution (ca. 0.05% w/w) = 2.1.

**% Volatiles by volume @ 21C (70F):**

> 95

**Boiling Point:**

No information found.

**Melting Point:**

3C (100%), -32C (93%), -38C (78%), -64C (65%).

**Vapor Density (Air=1):**

No information found.

**Vapor Pressure (mm Hg):**

No information found.

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

### Stability:

Stable under ordinary conditions of use and storage.

### Hazardous Decomposition Products:

(The following information applies to concentrated solutions). Toxic fumes of oxides of sulfur when heated to decomposition. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

### Hazardous Polymerization:

Will not occur.

### Incompatibilities:

Potassium chlorate, potassium perchlorate, potassium permanganate, sodium, lithium, bases, organic material, halogens, metal acetylides, oxides and hydrides, metals (yields hydrogen gas), strong oxidizing and reducing agents and many other reactive substances.

### Conditions to Avoid:

Heat, incompatibles.

---

## 11. Toxicological Information

### Toxicological Data:

Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m<sup>3</sup>/2H; standard Draize, eye rabbit, 250 ug (severe); investigated as a tumorigen, mutagen, reproductive effector.

### Carcinogenicity:

Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containing sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Sulfuric Acid (7664-93-9)	No	No	None
Water (7732-18-5)	No	No	None

---

## 12. Ecological Information

### Environmental Fate:

When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.

### Environmental Toxicity:

LC50 Flounder 100 to 330 mg/l/48 hr aerated water/Conditions of bioassay not specified; LC50 Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC50 Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified.

This material may be toxic to aquatic life.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

### Domestic (Land, D.O.T.)

**Proper Shipping Name:** SULFURIC ACID (WITH NOT MORE THAN 51% ACID)

**Hazard Class:** 8

**UN/NA:** UN2796

**Packing Group:** II

**Information reported for product/size:** 20L

### International (Water, I.M.O.)

**Proper Shipping Name:** SULPHURIC ACID (WITH NOT MORE THAN 51% ACID)

**Hazard Class:** 8

**UN/NA:** UN2796

**Packing Group:** II

**Information reported for product/size:** 20L

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Sulfuric Acid (7664-93-9)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Sulfuric Acid (7664-93-9)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302- RQ	TPQ	-SARA 313- List	Chemical Catg.
Sulfuric Acid (7664-93-9)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8 (d)
Sulfuric Acid (7664-93-9)	1000	No	No

Water (7732-18-5)

No

No

No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes  
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No  
Reactivity: No (Pure / Liquid)

**Australian Hazchem Code: 2R**

**Poison Schedule:** None allocated.

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

## 16. Other Information

**NFPA Ratings:** Health: 3 Flammability: 0 Reactivity: 0

**Label Hazard Warning:**

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

**Label Precautions:**

Do not get in eyes, on skin, or on clothing.

Do not breathe mist.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

**Label First Aid:**

In all cases call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use. Excess acid on skin can be neutralized with a 2% bicarbonate of soda solution. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

No Changes.

**Disclaimer:**

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\*\*\*\*\*

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OF OR RELIANCE UPON THIS INFORMATION.**

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**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

**MSDS****Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



Mallinckrodt  
CHEMICALS



24 Hour Emergency Telephone: 908-856-2151  
CHEMTREC: 1-800-424-9300

National Response in Canada  
CANUTEC: 613-696-6666

Outside U.S. and Canada  
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

# ISOPROPYL ALCOHOL (90 - 100%)

## 1. Product Identification

**Synonyms:** 2-Propanol; sec-propyl alcohol; isopropanol; sec-propanol; dimethylcarbinol

**CAS No.:** 67-63-0

**Molecular Weight:** 60.10

**Chemical Formula:** (CH<sub>3</sub>)<sub>2</sub>CHOH

**Product Codes:**

J.T. Baker: 0562, 5082, 9037, 9080, U298

Mallinckrodt: 0562, 3027, 3031, 3032, 3035, 3037, 3043, 4359, 6569, H604, H982, V555, V566, V681

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Isopropyl Alcohol	67-63-0	90 - 100%	Yes
Water	7732-18-5	0 - 10%	No

## 3. Hazards Identification

### Emergency Overview

**WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.**

**SAF-T-DATA<sup>(tm)</sup> Ratings** (Provided here for your convenience)

Health Rating: 2 - Moderate

Flammability Rating: 3 - Severe (Flammable)

Reactivity Rating: 2 - Moderate

Contact Rating: 3 - Severe

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER  
Storage Color Code: Red (Flammable)

---

## Potential Health Effects

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### Inhalation:

Inhalation of vapors irritates the respiratory tract. Exposure to high concentrations has a narcotic effect, producing symptoms of dizziness, drowsiness, headache, staggering, unconsciousness and possibly death.

### Ingestion:

Can cause drowsiness, unconsciousness, and death. Gastrointestinal pain, cramps, nausea, vomiting, and diarrhea may also result. The single lethal dose for a human adult = about 250 mls (8 ounces).

### Skin Contact:

May cause irritation with redness and pain. May be absorbed through the skin with possible systemic effects.

### Eye Contact:

Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

### Chronic Exposure:

Chronic exposure may cause skin effects.

### Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this agent.

---

## 4. First Aid Measures

### Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

### Ingestion:

Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.

### Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes. Call a physician if irritation develops.

### Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

## 5. Fire Fighting Measures

### Fire:

Flash point: 12C (54F) CC

Autoignition temperature: 399C (750F)

Flammable limits in air % by volume:

lcl: 2.0; ucl: 12.7

Listed fire data is for Pure Isopropyl Alcohol.

### Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.

**Fire Extinguishing Media:**

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

## 7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Small quantities of peroxides can form on prolonged storage. Exposure to light and/or air significantly increases the rate of peroxide formation. If evaporated to a residue, the mixture of peroxides and isopropanol may explode when exposed to heat or shock.

---

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

For Isopropyl Alcohol (2-Propanol):

-OSHA Permissible Exposure Limit (PEL): 400 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):

200 ppm (TWA), 400 ppm (STEL), A4 - not classifiable as a human carcinogen.

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded, a full facepiece respirator with organic vapor cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene and nitrile rubber are recommended materials.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Clear, colorless liquid.

**Odor:**

Rubbing alcohol.

**Solubility:**

Miscible in water.

**Specific Gravity:**

0.79 @ 20C/4C

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

100

**Boiling Point:**

82C (180F)

**Melting Point:**

-89C (-128F)

**Vapor Density (Air=1):**

2.1

**Vapor Pressure (mm Hg):**

44 @ 25C (77F)

**Evaporation Rate (BuAc=1):**

2.83

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage. Heat and sunlight can contribute to instability.

**Hazardous Decomposition Products:**

Carbon dioxide and carbon monoxide may form when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Heat, flame, strong oxidizers, acetaldehyde, acids, chlorine, ethylene oxide, hydrogen-palladium

combination, hydrogen peroxide-sulfuric acid combination, potassium tert-butoxide, hypochlorous acid, isocyanates, nitroform, phosgene, aluminum, oleum and perchloric acid.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

## 11. Toxicological Information

Oral rat LD50: 5045 mg/kg; skin rabbit LD50: 12.8 gm/kg; inhalation rat LC50: 16,000 ppm/8-hour; investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Isopropyl Alcohol (67-63-0)	No	No	3
Water (7732-18-5)	No	No	None

---

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into water, this material may biodegrade to a moderate extent. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

**Environmental Toxicity:**

The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be toxic to aquatic life.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

## 14. Transport Information

Domestic (Land, D.O.T.)

-----  
**Proper Shipping Name:** ISOPROPANOL

**Hazard Class:** 3

**UN/NA:** UN1219

**Packing Group:** II

Information reported for product/size: 200L

International (Water, I.M.O.)

-----  
Proper Shipping Name: ISOPROPANOL

Hazard Class: 3

UN/NA: UN1219

Packing Group: II

Information reported for product/size: 200L

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## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----  
Ingredient TSCA EC Japan Australia  
-----  
Isopropyl Alcohol (67-63-0) Yes Yes Yes Yes  
Water (7732-18-5) Yes Yes Yes Yes

-----\Chemical Inventory Status - Part 2\-----  
Ingredient Korea --Canada-- DSL NDSL Phil.  
-----  
Isopropyl Alcohol (67-63-0) Yes Yes No Yes  
Water (7732-18-5) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----  
Ingredient -SARA 302- --SARA 313--  
RQ TPQ List Chemical Catg.  
-----  
Isopropyl Alcohol (67-63-0) No No Yes No  
Water (7732-18-5) No No No No

-----\Federal, State & International Regulations - Part 2\-----  
Ingredient CERCLA -RCRA- -TSCA-  
261.33 8(d)  
-----  
Isopropyl Alcohol (67-63-0) No No No  
Water (7732-18-5) No No No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes  
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No  
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2[S]2

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

## 16. Other Information

NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0

Label Hazard Warning:

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED.

CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.

**Label Precautions:**

Keep away from heat, sparks and flame.  
Keep container closed.  
Use only with adequate ventilation.  
Wash thoroughly after handling.  
Avoid breathing vapor or mist.  
Avoid contact with eyes, skin and clothing.

**Label First Aid:**

If swallowed, give large amounts of water to drink. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

No Changes.

**Disclaimer:**

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Prepared by: Environmental Health & Safety  
Phone Number: (314) 654-1600 (U.S.A.)

**ISOBUTYLENE**

AIRGAS INC

-- ISOBUTYLENE-C4H8

=====

MSDS Safety Information

=====

FSC: 6665  
NIIN: 01-214-8247  
MSDS Date: 01/16/1998  
MSDS Num: CLCRL  
Product ID: ISOBUTYLENE-C4H8  
MFN: 01  
Responsible Party  
Cage: UO451  
Name: AIRGAS INC  
Address: 259 RADNOR-CHESTER RD SUITE 100  
City: RADNOR PA 19087-5240  
Info Phone Number: 1-610-687-5253  
Emergency Phone Number: (800)424-9300  
Resp. Party Other MSDS No.: DOCUMENT NUMBER: 1031  
Chemtrec IND/Phone: (800)424-9300  
Published: Y

=====

Preparer Co. when other than Responsible Party Co.

=====

Cage: 0KBF5  
Name: CHEMICAL SAFETY ASSOCIATES INC  
Address: 9163 CHESAPEAKE DR  
City: SAN DIEGO CA 92123-1002

=====

Contractor Summary

=====

Cage: UO451  
Name: AIRGAS INC  
Address: 259 RADNOR-CHESTER RD SUITE 100  
City: RADNOR PA 19087-5240  
Phone: 1-610-687-5253  
Cage: 7Z016  
Name: KAMPI COMPONENTS CO., INC.  
Address: 210 RT 13  
Box: 721  
City: BRISTOL PA 19007-3517  
Phone: 215-736-2000  
Contract Number: SP0440-00-M-JA63

=====

Item Description Information

=====

Item Manager: S9G  
Item Name: CALIBRATION GAS CYL  
Specification Number: NONE  
Type/Grade/Class: NONE  
Unit of Issue: EA  
UI Container Qty: 1  
Type of Container: CYLINDER

=====

Ingredients

=====

Cas: 115-11-7  
RTECS #: UD0890000  
Name: ISOBUTYLENE  
> Wt: 90.

-----

Name: MAXIMUM IMPURITIES  
< Wt: 1.

=====

Health Hazards Data

=====

Route Of Entry Inds - Inhalation: YES  
Carcinogenicity Inds - NTP: NO  
IARC: NO  
OSHA: NO  
Effects of Exposure: ACUTE: THE MOST SIGNIFICANT HAZARD IS OXYGEN-DEFICIENT

ATOMSPHERES. AT HIGH CONCENTRATIONS UNCONSCIOUSNESS OR DEATH MAY OCCUR. CONTACT WITH LIQUIDIFIED GAS OR RAPIDLY EXPANDING GASES MAY CAUSE FROSTBIT E. ISOBUTYLENE ALSO HAS SOME DEGREE OF ANESTHETIC ACTION AND CAN BE MILDLY IRRITATING TO THE MUCOUS MEMBRANES. CHRONIC: NO KNOWN ADVERSE HEALTH EFFECTS ASSOCIATED WITH CHRONIC EXPOSURE TO ISOBUTYLENE. TARGET ORGANS: RESPIRATORY SYSTEM.

Explanation Of Carcinogenicity: ISOBUTYLENE IS NOT FOUND ON THE FOLLOWING LISTS: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, AND THEREFORE IS NEITHER CONSIDERED TO BE NOR SUSPECTED TO BE A CANCER-CAUSING AGENT BY THESE AGENCIES.

Signs And Symptoms Of Overexposure: INHALATION: SYMPTOMS OF OXYGEN DEFICIENCY INCLUDE RESPIRATORY DIFFICULTY, HEADACHES, RINGING IN EARS, DIZZINESS, DROWSINESS, UNCONSCIOUSNESS, NAUSEA, VOMITING, AND DEPRESSION OF ALL THE SENSES. UNDER SOME CIRCUMSTANCES OF OVEREXPOSURE, DEATH MAY OCCUR.

First Aid: RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO ISOBUTYLENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. AT A MINIMUM, SELF-CONTAINED BREATHING APPARATUS AND FIRE-RETARDANT PERSONAL PROTECTIVE EQUIPMENT SHOULD BE WORN. FIRE PROTECTION MUST BE PROVIDED DURING RESCUE SITUATIONS. REMOVE VICTIMS(S) TO FRESH AIR. TRAINED PERSONNEL SHOULD ADMINISTER OXYGEN AND/OR CARDIO-PULMONARY RESUSCITATION, IF NECESSARY. IN CASE OF FROSTBITE, PLACE FROSTBITEN PART IN WARM WATER. (CONTD. SEE OTHER INFORMATION)

#### Handling and Disposal

Spill Release Procedures: UNCONTROLLED RELEASES SHOULD BE COVERED BY TRAINED PERSONNEL USING PRE-PLANNED PROCEDURES. PROPER PROTECTIVE EQUIPMENT SHOULD BE USED. ADEQUATE FIRE PROTECTION MUST BE PROVIDED. MINIMUM PERSONAL PROTECTIVE EQUIPMENT SHOULD BE LEVEL B: FIRE RETARDANT PROTECTIVE CLOTHING, GLOVES RESISTANT TO TEARS AND SELF CONTAINED BREATHING APPARATUS. USE NON-SPARKING TOOLS AND (CONTD. SEE "WASTE DISPOSAL")

Waste Disposal Methods: WASTE DISPOSAL MUST BE IN ACCORDANCE WITH APPROPRIATE FEDERAL, STATE, AND LOCAL REGULATIONS. RETURN CYLINDERS WITH ANY RESIDUAL PRODUCT TO AIRGAS INC. DO NOT DISPOSE OF LOCALLY. (CONTD. FROM "SPILL RELEASE") EQUIPMENT. IF NOT ABLE TO STOP RELEASE, ALLOW GAS TO RELEASE IN PLACE OR REMOVE TO A SAFE AREA AND ALLOW GAS TO RELEASE.

Handling And Storage Precautions: STORE IN COOL (< 125F), DRY, WELL-VENTILATED AREA AWAY FROM SOURCES OF HEAT, IGNITION, DIRECT SUNLIGHT. COMPRESSED GASES PRESENT SAFETY HAZARD. STORE AWAY FROM OXIDIZERS, OXYGEN, CHLORINE, FLUORINE, HEAVILY TRAFFICKED AREAS, EMERGENCY EXITS. POST "NO SMOKING OR NO OPEN FLAMES" SIGNS.

Other Precautions: ELECTRICAL EQUIPMENT SHOULD BE NON-SPARKING. MOVE CYLINDERS WITH HAND TRUCK. DO NOT DRAG, ROLL, DROP, STRIKE EACH OTHER. SECURE FIRMLY. DO NOT HEAT CYLINDER OR USE OILS OR GREASE ON GAS-HANDLING FITTINGS OR EQUIPMENT. USE DESIGNATED CGA FITTINGS. DO NOT USE ADAPTERS. USE CHECK VALVE OR TRAP IN DISCHARGE LINE.

#### Fire and Explosion Hazard Information

Flash Point Method: CC

Flash Point: <-10.C, 14.F

Autoignition Temp: =465.C, 869.F

Lower Limits: 1.8

Upper Limits: 9.6

Extinguishing Media: EXTINGUISH ISOBUTYLENE FIRES BY SHUTTING OFF THE SOURCE OF THE GAS. USE WATER SPRAY OR A FOAM AGENT TO COOL FIRE-EXPOSED CONTAINERS, STRUCTURES AND EQUIPMENT.

Fire Fighting Procedures: STRUCTURAL FIREFIGHTERS MUST WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE EQUIPMENT. THE BEST FIRE-FIGHTING TECHNIQUE MAY BE SIMPLY TO LET THE BURNING GAS ESCAPE FROM THE PRESSURIZED CYLINDER, TANK CAR, OR PIPELINE. STOP THE LEAK BEFORE EXTINGUISHING FIRE. LEAKING GAS COULD EXPLOSIVELY RE-IGNITE.

Unusual Fire/Explosion Hazard: WHEN INVOLVED IN A FIRE, THIS MATERIAL MAY IGNITE AND PRODUCE TOXIC GASES, INCLUDING CARBON MONOXIDE AND CARBON DIOXIDE.

#### Control Measures

Respiratory Protection: MAINTAIN OXYGEN LEVELS ABOVE 19.5% IN THE WORKPLACE.  
USE SUPPLIED AIR RESPIRATORY PROTECTION IF OXYGEN LEVELS ARE BELOW 19.5% OR  
DURING EMERGENCY RESPONSE TO A RELEASE OF ISOBUTYLENE. IF RESPIRATORY PROTECTION IS REQUIRED, FOLLOW THE REQUIREMENTS OF THE FEDERAL OSHA RESPIRATORY STANDARD (29 CFR 1910.134) OR EQUIVALENT STATE STANDARDS.

Ventilation: USE ADEQUATE VENTILATION. LOCAL EXHAUST VENTILATION IS PREFERRED, BECAUSE IT PREVENTS ISOBUTYLENE DISPERSION INTO THE WORKPLACE BY ELIMINATING IT AT THE SOURCE

Protective Gloves: RESISTANT TO TEARS. USE LOW-TEMPERATURE PROTECTIVE GLOVED (E.G., KEVLAR)

Eye Protection: SPLASH GOGGLES OR SAFETY GLASSES.

Other Protective Equipment: USE BODY PROTECTION. TRANSFER OF LARGE QUANTITIES UNDER PRESSURE MAY REQUIRE PROTECTIVE EQUIPMENT TO PROTECT FROM SPLASHES OF LIQUIDIFIED PRODUCT AS WELL AS FIRE RETARDANT ITEMS.

Work Hygienic Practices: AS WITH ALL CHEMICALS, AVOID GETTING ISOBUTYLENE IN YOU. DO NOT EAT OR DRINK WHILE HANDLING CHEMICALS. BEWARE OF ANY SIGNS OF DIZZINESS OR FATIGUE; EXPOSURES TO FATAL CONCENTRATIONS OF ISOBUTYLENE COULD

Supplemental Safety and Health: (CONTD. FROM FIRST AID) DO NOT USE HOT WATER. IF WARM WATER NOT AVAILABLE, OR IMPRACTICAL TO USE, WRAP AFFECTED PARTS GENTLY IN BLANKETS. (SEE OTHER INFORMATION)

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#### Physical/Chemical Properties

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HCC: G2

Boiling Point:  $-6.9^{\circ}\text{C}$ ,  $19.6^{\circ}\text{F}$

Melt/Freeze Pt:  $-140^{\circ}\text{C}$ ,  $-220^{\circ}\text{F}$

Vapor Pres: 39 PSIA

Vapor Density: 0.15LB/FT<sup>3</sup>

Spec Gravity: 1.997

PH: NA

Solubility in Water: INSOLUBLE

Appearance and Odor: COLORLESS LIQUID/ GAS WITH THE UNPLEASANT ODOR OF BURNING COAL.

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#### Reactivity Data

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Stability Indicator: YES

Stability Condition To Avoid: CONTACT WITH INCOMPATIBLE MATERIALS AND EXPOSURE TO HEAT, SPARKS, AND OTHER SOURCES OF IGNITION. CYLINDERS EXPOSED TO HIGH TEMPERATURES OR DIRECT FLAME CAN RUPTURE OR BURST.

Materials To Avoid: STRONG OXIDIZERS (E.G., CHLORINE, BROMINE PENTAFLUORIDE, OXYGEN, OXYGEN DIFLUORIDE, AND NITROGEN TRIFLUORIDE).

Hazardous Decomposition Products: WHEN IGNITED IN THE PRESENCE OF OXYGEN, THIS GAS WILL BURN TO PRODUCE CARBON MONOXIDE AND CARBON DIOXIDE.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: WILL NOT OCCUR.

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#### Toxicological Information

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Toxicological Information: LC50 (RAT, INHALATION): 620 G/M<sup>3</sup>/ 4 HOURS; LC50 (MOUSE, INHALATION): 415 G/M<sup>3</sup>/ 2 HOUR. ISOBUTYLENE IS NOT FOUND ON FEDERAL OSHA LIST, NTP, IARC, CAL/OSHA, AND THEREFORE IS NEITHER CONSIDERED TO BE A SUSPECTED TO BE A CANCER-CAUSING AGENT BY THESE AGENCIES. PRODUCT MAY BE MILDLY IRRITATING TO THE MUCOUS MEMBRANES. IN ADDITION, CONTACT WITH RAPIDLY EXPANDING GASES CAN CAUSE FROSTBITE TO EXPOSED TISSUE. ISOBUTYLENE IS NOT KNOWN TO CAUSE SENSITIZATION IN HUMANS. NO MUTAGENIC EFFECTS, NO EMBRYOTOXIC EFFECTS, NO TERATOGENIC EFFECTS, NO REPRODUCTIVE TOXICITY EFFECTS HAVE BEEN DESCRIBED FOR BUTYLENE.

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#### Ecological Information

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Ecological: ENVIRONMENTAL STABILITY: THIS GAS WILL BE DISSIPATED RAPIDLY IN WELL-VENTILATED AREAS. EFFECTS OF MATERIAL ON PLANTS OR ANIMALS: ANY ADVERSE EFFECT ON ANIMALS WOULD BE RELATED TO OXYGEN-DEFICIENT ENVIRONMENTS. NO ADVERSE EFFECT IS ANTICIPATED TO OCCUR TO PLANT LIFE, EXCEPT FOR FROST

PRODUCED IN THE PRESENCE OF RAPIDLY EXPANDING GASES. EFFECT OF CHEMICAL ON  
AQUATIC LIFE: NO EVIDENCE IS CURRENTLY AVAILABLE ON THE EFFECTS OF  
ISOBUTYLENE ON AQUATIC LIFE.

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MSDS Transport Information

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Transport Information: THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101  
BY THE U.S. DEPARTMENT OF TRANSPORTATION. PROPER SHIPPING NAME: ISOBUTYLENE;  
CLASS: 2.1 (FLAMMABLE GAS); UN 1055; PKG: N/A; DOT LABELS REQUIRED:  
FLAMMABLE GAS; NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):  
115. ALTERNATE DESCRIPTION: PSN: PETROLEUM GASES, LIQUIDIFIED; CLASS: 2.1  
(FLAMMABLE GAS); UN 1075; PKG N/A; DOT LABEL REQUIRE D: FLAMMABLE GAS; NORTH  
AMERICAN EMERGENCY GUIDEBOOK NUMBER: 115; MARINE POLLUTANT: ISOBUTYLENE IS  
NOT CLASSIFIED BY THE DOT AS A MARINE POLLUTANT ( AS DEFINED BY 49 CFR  
172.101, APPENDIX B). CANADA: SAME AS ABOVE.

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Regulatory Information

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Sara Title III Information: ISOBUTYLENE IS NOT SUBJECT TO THE REPORTING  
REQUIREMENTS OF SECTION 302, 304, AND 313 OF TITLE I I I OF THE SUPERFUND  
AMENDMENTS AND REAUTHORIZATION ACT. U.S. SARA THRESHOLD PLANNING QUANTITY:  
N/A. U. S. CERCLA REPORTABLE QUANTITY (RQ): NOT APPLICABLE.ING RE  
Federal Regulatory Information: ISOBUTYLENE IS LISTED ON THE U.S. TSCA  
INVENTORY. ISOBUTYLENE IS SUBJECT TO REPORTING REQUIREMENTS OF SECTION 112(R)  
OF THE CLEAN AIR ACT. THRESHOLD QUANTITY FOR THIS GAS IS 10,000 LB. DEPENDING  
ON SP ECIFIC OPERATIONS INVOLVING USE OF ISOBUTYLENE, REGULATIONS OF THE  
PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS MAY BE APPLICABLE (29  
CFR 1910.119) UNDER THIS REGULATION ISOBUTYLENE IS NOT LISTED IN APPENDIX A;  
HOWEVER, ANY PROCESS THAT INVOLVES A FLAMMABLE GAS ON-SITE, IN ONE LOCATION,  
I N QUANTITIES OF 10,000 LB (4,553 KG) OR GREATER IS COVERED UNDER THIS  
REGULATION UNLESS IT IS USED AS A FUEL.

State Regulatory Information: CALIFORNIA SAFE DRINKING WATER AND TOXIC  
ENFORCEMENT ACT (PROPOSITION 65): ISOBUTYLENE IS NOT ON THE CALIFORNIA  
PROPOSITION 65 LISTS. PRODUCT COVERED UNDER FOLLOWING STATE REGULATIONS: AK:  
DESIGNATED TOXIC AND HAZARDOUS SUBSTANCES. CA: PERMISSIBLE EXPOSURE LIMITS  
FOR CHEMICAL CONTAMINANTS; FL:SUBSTANCE LIST; MA: SUBSTANCE LIAT; MN:LIST OF  
HAZARDOUS SUBSTANCES; NJ: RIGHT TO KNOW HAZARDOUS SUBSTANCE LIST; PA:  
HAZARDOUS SUBSTANCE LIST; RI: HAZARDOUS SUBSTANCE LIST; TX: HAZARDOUS  
SUBSTANCE LIST; WV: HAZARDOUS SUBSTANCE LIST; WI: TOXIC AND HAZARDOUS  
SUBSTANCES.

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Other Information

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Other Information: (CONTD. FROM FIRST AID) DO NOT USE HOT WATER. IF WARM WATER  
NOT AVAILABLE, WRAP AFFECTED PARTS IN BLANKETS. ALTERNATIVELY, IF FINGERS OR  
HANDS ARE FORTBITTEN, PLACE IN ARMPIT. HAVE VICTIM GENTLY EXERC ISE AFFECTED  
PARTS WHILE BEING WARMED. SEEK MEDICAL ATTENTION. TAKE COPY OF LABEL AND  
MSDS TO PHYSICIAN WITH VICTIM.NFPA RATING: HEALTH: 1; FLAMMIBILITY: 4;  
REACTIVITY: 0. RATINGS: HEALTH: 1; FLAMMABILITY: 4; REACTIVITY: 0;  
PROTECTIVE EQUIPMENT: B. CANADIAN W SYMBOLS: CLASS A: COMPRESSED GAS; CLASS  
B1: FLAMMABLE GAS.

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Transportation Information

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Responsible Party Cage: U0451  
Trans ID NO: 156921  
Product ID: ISOBUTYLENE-C4H8  
MSDS Prepared Date: 01/16/1998  
Review Date: 05/14/2001  
MFN: 1  
Multiple KIT Number: 0  
Unit Of Issue: EA  
Container QTY: 1  
Type Of Container: CYLINDER  
Additional Data: TRANSPORTATION DATA PER MANUFACTURER'S MSDS.

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Detail DOT Information

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DOT PSN Code: HTR  
DOT Proper Shipping Name: ISOBUTYLENE  
DOT PSN Modifier: SEE ALSO PETROLEUM GASES, LIQUEFIED  
Hazard Class: 2.1  
UN ID Num: UN1055  
Label: FLAMMABLE GAS  
Special Provision: 19  
Packaging Exception: 306  
Non Bulk Pack: 304  
Bulk Pack: 314,315  
Max Qty Pass: FORBIDDEN  
Max Qty Cargo: 150 KG  
Vessel Stow Req: E  
Water/Ship/Other Req: 40  
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Detail IMO Information

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IMO PSN Code: IRQ  
IMO Proper Shipping Name: ISOBUTYLENE  
IMDG Page Number: 2147  
UN Number: 1055  
UN Hazard Class: 2(2.1)  
IMO Packaging Group: -  
Subsidiary Risk Label: -  
EMS Number: 2-07  
MED First Aid Guide NUM: 310  
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Detail IATA Information

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IATA PSN Code: OHI  
IATA UN ID Num: 1055  
IATA Proper Shipping Name: ISOBUTYLENE  
IATA UN Class: 2.1  
IATA Label: FLAMMABLE GAS  
Packing Note Passenger: FORB  
Max Quant Pass: FORB  
Max Quant Cargo: 150KG  
Packaging Note Cargo: 200  
Exceptions: A1  
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Detail AFI Information

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AFI PSN Code: OHI  
AFI Proper Shipping Name: ISOBUTYLENE  
AFI Hazard Class: 2.1  
AFI UN ID NUM: UN1055  
Special Provisions: P4  
Back Pack Reference: A6.3, A6.5  
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HAZCOM Label

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Product ID: ISOBUTYLENE-C4H8  
Cage: UO451  
Assigned IND: Y  
Company Name: AIRGAS INC  
Street: 259 RADNOR-CHESTER RD SUITE 100  
City: RADNOR PA  
Zipcode: 19087-5240  
Health Emergency Phone: (800)424-9300  
Label Required IND: Y  
Date Of Label Review: 05/14/2001  
Status Code: A  
Label Date: 05/14/2001  
Origination Code: F  
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Eye Protection IND: YES

Skin Protection IND: YES

Signal Word: DANGER

Respiratory Protection IND: YES

Health Hazard: Moderate

Contact Hazard: Moderate

Fire Hazard: Severe

Reactivity Hazard: None

Hazard And Precautions: FLAMMABLE LIQUID AND GAS UNDER PRESSURE. CAN FORM  
EXPLOSIVE MIXTURES WITH AIR. MAY CAUSE FROSTBITE. KEEP AWAY FROM HEAT (<  
125F), FLAMES, AND SPARKS. STORE AND USE WITH ADEQUATE VENTILATION. MOST SIGN  
IFICANT HAZARD IS OXYGEN-DEFICIENT ATOMSPHERES.

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